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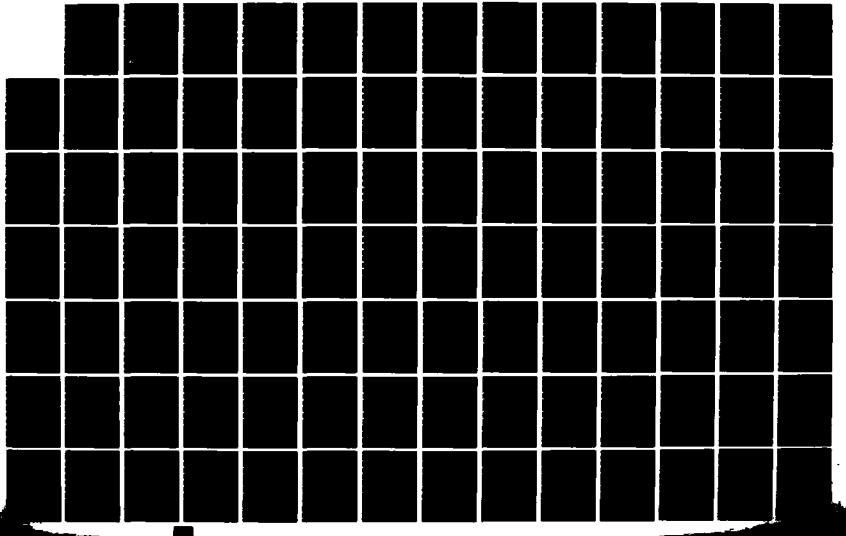

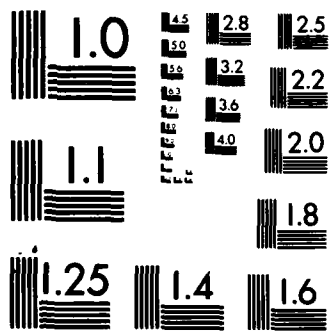

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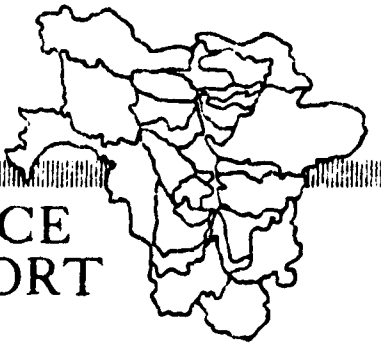

RECONNAISSANCE REPORT

ELM RIVER SUBBASIN

FINAL REPORT
December 1980

ST. PAUL DISTRICT: U.S. ARMY CORPS OF ENGINEERS

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RED RIVER BASIN

20. ABSTRACT *(Continue on reverse side if necessary and identify by block number)*

This report is one of 23 subbasin reports produced by the St. Paul District Corps of Engineers in connection with a reconnaissance report for the whole of the Red River Basin. The reconnaissance report is itself part of the overall Red River of the North study, which was initiated by Congress in 1957 in order to develop solutions for flooding problems within the basin.

The purpose of a reconnaissance study is to provide an overview of the water and related land resource problems and needs within a particular geographic area, to identify planning objectives, to assess potential solutions and

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problems, to determine priorities for immediate and longrange action, and to identify the capabilities of various governmental units for implementing the actions.

The information developed in this report has been combined with information developed in the other subbasin reports to produce a main report covering the basin as a whole. The various flood control measures discussed in this and in other subbasin reports are combined in the main report to develop the outline of an integrated flood control plan for the basin within the context of a comprehensive plan.

The Elm River Subbasin is an irregularly shaped piece of land occupying 510 square miles of the central North Dakota portion of the Red River Basin. It is one of the smallest of the subbasins, occupying portions of three counties: Cass, Traill, and Steele. Most of the area is a featureless lake plain broken by wavelike swells or beachlines with intervening sloughs and depressions. It has a claim to distinction in that it is almost totally under cultivation (94%).

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December 1980

Final Report

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RECONNAISSANCE REPORT: RED RIVER OF THE NORTH BASIN, ELM RIVER SUBBASIN

Prepared for:

U.S. Army Corps of Engineers
St. Paul District
St. Paul, Minnesota

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This report is one of 23 subbasin reports produced by the St. Paul District Corps of Engineers in connection with a reconnaissance report for the whole of the Red River Basin. The reconnaissance report is itself part of the overall Red River of the North Study, which was initiated by Congress in 1957 in order to develop solutions for flooding problems within the basin.

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The Elm River Subbasin is a water resource planning unit located in the central North Dakota portion of the Red River Basin. This report describes the social, economic, and environmental resources of the subbasin, identifies the water-related problems, needs, and desires, and suggests measures for meeting the needs, particularly in the area of flood control.

The report was prepared almost entirely on the basis of secondary information. However, some telephone contacts were made to verify information and to acquire a more complete picture of local conditions. The only comprehensive report available on the subbasin is a 1957 document entitled Watershed Work Plan, Elm River Watershed, which was published by the U.S. Department of Agriculture, Soil Conservation Service. Other published sources on the subbasin include The Comprehensive Water Resources Plan For Traill County, which was published in 1976 by the Traill County Water Management District and describes the water resource plan for Traill County.

In addition, the subbasin received partial coverage in the Souris-Red-Rainy River Basins Comprehensive Study, which was published by the Souris-Red-Rainy River Basins Commission in 1972, and in the Red River of the North Basin Plan of Study, which was published by the St. Paul District Corps of Engineers in 1977.

The information developed in this report has been combined with information developed in the other subbasin reports to produce a main report covering the basin as a whole. The various flood control measures discussed in this and in other subbasin reports are combined in the main report to develop the outline of an integrated flood control plan for the basin within the context of a comprehensive plan.

II. DESCRIPTION OF STUDY AREA

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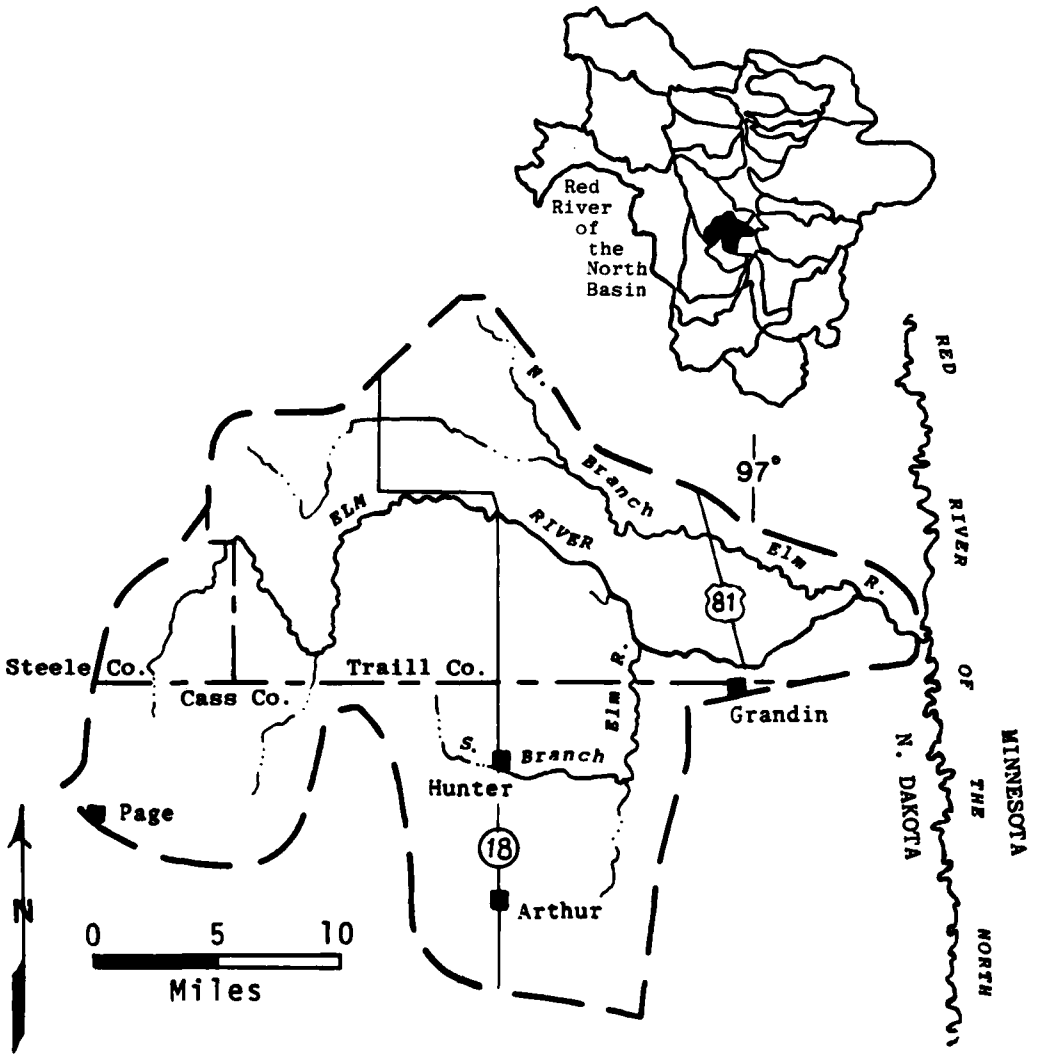
The Elm River Subbasin is an irregularly shaped piece of land occupying 510 square miles of the central North Dakota portion of the Red River Basin. It is bounded on the north and west by the Goose River Subbasin, on the east by the Main Stem Subbasin, and on the south by the Rush River Subbasin. Although the Elm River Subbasin is one of the smallest of the subbasins, it occupies portions of three counties: Cass, Traill, and Steele. Water management districts have been formed in Traill County and Steele County, but the subbasin does not itself have a legal status.

The subbasin is bordered by rolling glacial upland on the west, but most of the area is a level, featureless lake plain broken by wave-like swells or beachlines with intervening sloughs and depressions. It has a claim to distinction in that it is almost totally under cultivation (94 percent). In addition, unlike most other subbasins, it is fairly round rather than elongated, and the Elm River enters the Red River at a slight angle rather than paralleling for a distance before finally entering it.

The Elm River rises in glaciated uplands near the town of Page, in Cass County. It flows in a northeasterly direction through the beachlines toward Blanchard in Traill County and then generally southeast across the plain formed by glacial Lake Agassiz, entering the Red River of the North about nine miles east of Kelso. Elevations range from approximately 1,200 feet above mean sea level in the headwaters area to 840 feet at the junction of the Elm River and the Red River. The principal channels of the subbasin flow northward, paralleling the main beachlines before cutting through them and flowing eastward to their junction with the Red River. Important tributaries to the Elm River include the North and South branches. Both the river and its tributaries have intermittent flows.



Source: Gulf South Research Institute.

Figure I. ELM RIVER SUBBASIN

III. PROBLEMS, NEEDS, AND DESIRES

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The primary water-related problems, needs, and desires in the Red River Basin are flood control, fish and wildlife conservation and enhancement, recreation, water supply, water quality, erosion control, irrigation, wastewater management, and hydropower. Various water-related problems, needs, and desires have been identified for the Elm River Subbasin in previous planning reports on the basis of analysis of conditions and public and agency comments. The list of problems, needs, and desires for the subbasin is the same as the list for the Red River Basin as a whole, with the exception of hydropower. Each problem is discussed separately below, with an emphasis on flooding problems.

Flooding Problems

Nature of the Problems

The development of the subbasin owes much to the growth of the agricultural economy, particularly the production of cash grain crops in the fertile soils of the Red River valley plain. This has naturally resulted in substantial rural floodplain encroachment. Urban encroachment (a small amount in Hunter) is much more limited than in the neighboring subbasins.

Floods within the subbasin occur seven out of every 10 years on the average. Most flooding conditions are brought about by spring snowmelt, sometimes combined with spring rains. These conditions in April and May cause delays in seeding crops, which, given the short growing season in this area, results in a significant reduction in yields. Moreover, if water stays on the land too long, it may be impossible to engage in planting operations altogether.

Flood damage also occurs from high-intensity summer storms during the months of June, July and August. Although they usually occur less frequently than spring snowmelt floods, high flows exceed channel capacity and cause damage to maturing crops. In fact, 54 percent of total crop damage in the subbasin results from such storms. Even short periods of inundation during summer months result in lower yields and poorer quality.

Two separate types of flooding occur: the most damaging type associated with river bank overflow (overbank flooding) and another type caused by runoff from snowmelt or heavy rainfall impounded by plugged culverts and ditches within sections of land bounded by roadways on earthen fill (overland flooding). In overland flooding, the trapped water slowly accumulates until it overflows the roadways and inundates section after section of land as it moves overland in the direction of the regional slope until reaching river or stream channels.

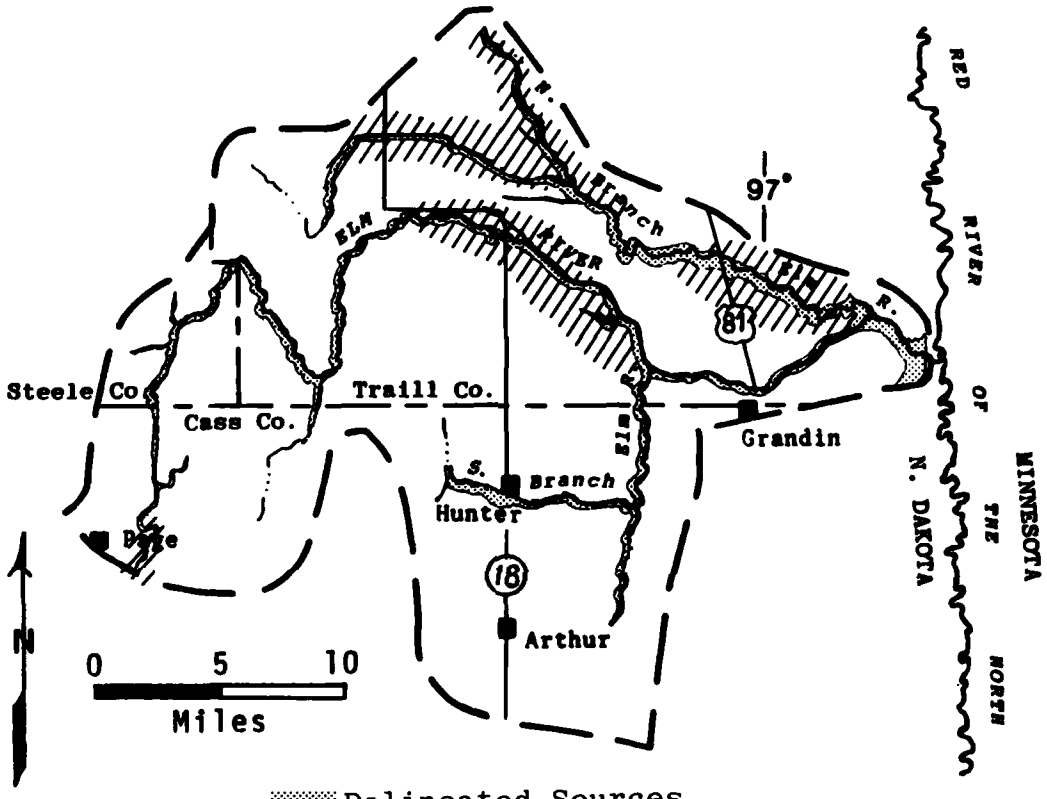
The topography of the subbasin also influences flooding problems. The Elm River originates in the glaciated upland bordering the west side of the Red River valley lacustrine plain. Major channels flow northward, paralleling beachlines of glacial Lake Agassiz before cutting through them and nearing the Red River. Shallow channels and diminished gradients in the latter area cause floodwaters to overflow existing channels onto the surrounding lacustrine plain, damaging cropland, farmsteads, and transportation facilities.

Location and Extent

Figure II depicts the 100-year floodplain for the subbasin. Prior to this study, no attempt had been made to publish even a generalized delineation of the entire subbasin. A number of sources were investigated in order to produce the present delineation. Among these were: (1) U.S. Geological Survey (USGS) Flood Prone Area Maps at 1:24,000 scale; (2) published secondary sources describing flooded areas; and (3) USGS 7½ minute topographic maps.

The map is thus a composite of available sources supplemented by inferences where necessary. Because the sources were incomplete and based on surveys differing in purpose and accuracy, it should be understood that Figure II constitutes a generalized delineation intended only for general planning purposes. A more complete description of sources and limitations is given in Appendix A.

According to this preliminary delineation, the Elm River 100-year floodplain comprises a total of 16,000 acres. Descriptive sources indicated by the cross-hatch pattern add another 40,000 acres, bringing the total to 56,000 acres. Major components of the floodplain from delineated



Source: Gulf South Research Institute.

Figure II. 100-YEAR FLOODPLAIN

sources include: North Branch, 4,000 acres; South Branch, 2,000 acres; and the Elm proper, 10,000 acres. The upper area of the latter (to South Branch) comprises approximately 6,000 acres. The lower Elm floodplain constitutes some 4,000 acres, about half of which is usually associated with flooding on the main stem Red River. Except for the latter area, maximum widths generally do not exceed one-half mile.

With one minor exception, the floodplain indicated from descriptive sources occurs across the northeast section of the subbasin (Figure II). These areas are based largely on damage areas designated in the Elm River Watershed Work Plan.

Flood Damages

Throughout the subbasin's floodplain, the following three primary areas are affected by flooding: urban, agricultural and environmental. Grandin is the only community in the floodplain that is subject to flooding. Urban and rural damages are the damages taken into account in the computation of average annual damages.

Present average annual damages in the subbasin are estimated at $173,100. This accounts for less than one percent of the Red River of the North basinwide total average annual damage figure. Average annual damages are divided into two basic classifications: urban and rural. Urban damages include damages to residences, businesses (commercial and industrial) and public facilities (streets, utilities, sewers, etc.). Rural damages include damages to crops, other agricultural assets (fences, farm machinery and buildings, etc.) and transportation facilities. Average annual urban damages are reported to be minor, and rural damages account for 100 percent of the average annual damages reported in the subbasin.

No urban damages were sustained in 1975, but the community of Grandin did sustain a total of $11,000 in urban damages as a result of the flood event of 1979. Damages sustained in the 1979 flood event are presented by category in Table 1. These urban flood damages include $5,500 in residential damages, $4,400 in damages to businesses and $1,100 in public damages.

Table 1

ELM RIVER SUBBASIN, ESTIMATED 1979 AND AVERAGE ANNUAL URBAN FLOOD DAMAGES (Thousands of 1979 Dollars)

	Urban Flood Damages	
Category	1979	Average Annual
Residential	$ 5.5	Minor
Business	4.4	Minor
Public	1.1	Minor
TOTAL	$11.0	Minor

Sources: Red River of the North Basin Plan of Study, April, 1977; Post Flood Report, 1979; and Gulf South Research Institute.

Average annual rural flood damages are presented in Table 2. There were no rural flood damages reported to have been incurred in either the flood event of 1975 or 1979. Average annual rural flood damages include $125,900 in crop damages, $42,000 in other agricultural damages and $5,200 in transportation damages. Total average annual rural flood damages are estimated at $173,100.

Table 2

ELM RIVER SUBBASIN, ESTIMATED AVERAGE ANNUAL RURAL FLOOD DAMAGES (Thousands of 1979 Dollars)

Category	Average Annual Damages
Crop	$125.9
Other Agricultural	42.0
Transportation	5.2
TOTAL	$173.1

Sources: Red River of the North Basin Plan of Study, April, 1977; and Gulf South Research Institute.

Environmental Concerns

Much of the woodlands, wetlands, and prairie that formerly occupied the Elm River Subbasin have been altered or eliminated by agricultural development and other land uses. Land use data for the subbasin show that approximately 94 percent, or 306,816 acres, of the total area (326,400 acres) is in cropland. Woodlands comprise only 0.1 percent, or 326 acres, of the total area. Range and pasture lands, which may harbor scattered prairie remnants, represent 1.7 percent (5,550 acres) of the total area. Wetlands, which are included under Water and Other land use categories, compose 1.4 percent (4,569 acres) of the subbasin's area. Wetlands actually comprise less than 1.4 percent, since the "Other" category includes uses such as transportation networks or highways. It is apparent from the land use data that the prime wildlife habitats of the subbasin have been reduced significantly in areal extent and that animal and plant populations dependent upon the communities either during migration or as resident species have been adversely affected. There is an apparent need to protect and conserve the remaining woodland, wetland, and prairie habitats and to enhance these environs wherever possible through such means as increased plantings of shelterbelts, windbreaks, and greenbelts, wetland restoration, etc. The Traill County Water Management District (1976) indicated that some of these needs have been recognized and satisfied in part by the North Dakota Game and Fish Department and local landowners. Provision of food and cover through various management practices has increased deer and small furbearing animal populations. However, it was noted that intensive agriculture has had a deleterious effect on waterfowl production through loss of suitable wetland habitat.

A problem identified for aquatic life is the degradation of water quality in the Elm River as a result of agricultural runoff, streambank clearing, and channelization. Although this situation exists, the river has a substantial fishery value in that the lower portions of the stream provide a moderate sport fishery and a moderate amount of forage fish production (U.S. Fish and Wildlife Service, 1979). The Traill County Water Management District (1976) indicated that fishing as a recreational activity is increasing and implied that impoundments for public fishing

would be of benefit, but they also pointed out that the use of impoundments in the subbasin may be prohibitive because most locations on the Elm River are too shallow to sustain a quality sport fishery. It was stated that water depths greater than 18 feet were needed to prevent fish kills. A need exists to improve the water quality conditions of the Elm River for the benefit of aquatic biota and wildlife that utilize this stream. These improvements would increase the fishery value and may supply increased recreational fishing opportunities to the point where impoundments are not necessary.

Recreation Problems

Recreation problems in the subbasin are directly related to the lack of natural lakes and forested areas. Aujustadt Dam provides the only water based recreational area of significance in the subbasin. The dam has the only stable water surface for boating. Local officials report heavy use of the area because of the lack of other facilities in the subbasin. The subbasin lies within North Dakota Planning Region V. Water-based activities, winter trails, parks, and camping are listed as primary recreational needs in the region. There are no wildlife management areas or state parks within the area. At the present time, residents of the subbasin must travel outside the area to fulfill many recreational needs.

The most important recreational problem in the subbasin is the lack of natural habitat necessary to sustain wildlife and waterfowl production. Land managment programs and incentives to local farmers have been developed and are supported by the Traill County Water Management Board.

Water Quality Problems

Very little information exists concerning the surface water quality of the Elm River. Observation stations should be established so that point and nonpoint dischargers can be monitored. Hoisveen (1976) reported a station at Grandin, but this monitoring station has since been abandoned. Dissolved oxygen levels reported from this recording station were within acceptable limits. TDS concentrations were consistently high.

Groundwater supplies in the subbasin are produced from several different aquifers. These aquifers normally produce extremely hard waters that are also characterized by excessive concentrations of TDS, iron, and sulfates (Hoisveen, 1976).

Water Supply Problems

The subbasin has few water supply problems. However, the groundwater supply is often of undesirable quality. The Page water supply has a high manganese concentration, and Arthur's supply is high in dissolved solids and iron.

Groundwater, originating in the form of artesian water, may be a source of stream pollution. Reportedly, there are about 250 unregulated wells flowing over the surface or into the Elm and Goose Rivers. These wells are generally highly mineralized and may be contributing to the high dissolved solids in the Goose and Elm Rivers during low flow stages.

The very modest future water supply requirements for the subbasin should be met without difficulty by present sources.

Erosion Problems

Wind erosion of the lighter, sandy soils is one of the major sources of sediment in streams and ditches. This windblown sediment can result in a decrease in the water holding capacity of waterways and drainage systems, further complicating flood problems. In the glacial till upland, and near the beachlines where there is sufficient slope, sheet erosion occurs. Damages from floodplain scour, gully erosion and streambank erosion are negligible due to low stream gradients and the low velocities of the floodwater as it leaves the channel and spreads across the land.

Irrigation

The subbasin is located within North Dakota's Planning Region V. Until recently, only limited amounts of acreage in the subbasin were being irrigated. The main reasons for this were the lack of adequate water supplies and the poor water quality. However, identification of the Page aquifer and increased interest in irrigation have resulted in the past few years in the irrigation of a significant number of acres.

Wastewater Management

Table 3 lists the water treatment facilities and needs of the subbasin. The data presented in this table indicate that only one or two communities are operating their treatment facilities at near capacity. Few minor modifications are required to provide adequate facilities that will meet future demands. Still, investigations should be conducted to determine the extent of pollutions from point and nonpoint sources (Shewman and North Dakota State Department of Health, no date; Hoisveen, 1976).

Hydropower

There are no hydropower facilities in the subbasin and the topography precludes any future developments. However, the basin offers some opportunities for small-scale hydroelectric developments, particularly in the Red Lake River Subbasin.

Public Perception of Problems and Solutions

The public's perception of problems and solutions in the subbasin has not been adequately defined because the Corps of Engineers has not conducted public meetings in the area. However, subbasin landowners have organized a comprehensive water conservation and flood control district under North Dakota state law.

The primary document for the identification of public perceptions is the Elm River Watershed Work Plan published in 1957 by the North Dakota Soil Conservation Service in cooperation with local sponsor agencies. Floodwater damage to agricultural land is cited as the principal problem within the subbasin. Fish and wildlife conservation and water quality improvement are identified as additional problems.

The water conservation and flood control district has the power of eminent domain and the power of taxation through the Boards of Commissioners of Traill, Steele, and Cass counties. The district also has authority to let contracts and to expend funds for operation and maintenance. Local sponsoring agencies entered into a working agreement with the district to carry out the structural program outlined in the SCS work plan. The plan has been carried out, and the project is now completed.

Table 3

WASTE TREATMENT FACILITIES AND NEEDS,
ELM RIVER SUBBASIN

Facility	Population Served	Design Flow (MGD)	Actual Flow (MGD)	Type Treatment	Surface Area (Total Acres)	Needs or Comments
Arthur	412	0.034	0.027	Secondary	5.2	New one-acre lagoon
Galesburg	134	0.016	0.008	Secondary	2.50	--
Grandin	187	0.020	0.012	Secondary	3.12	Enlarge lagoon
Hunter	362	0.074	0.024	Secondary	10.0	Remodel existing lagoon
Page	367	0.052	0.024	Secondary	7.1	Construct new lagoon

Source: Shewman and North Dakota State Department of Health, no date; North Dakota Statewide 208 Water Quality Management Plan, 1978.

Additional evidence for interest in flood control measures is contained in public hearings held in East Grand Forks in 1978 and 1979 before subcommittees of the Committee on Public Works and Transportation of the U.S. House of Representatives. From these documents, it is evident that most residents of the Red River Basin consider flood control to be the primary water related need for the area and that they are interested in whatever solutions may be proposed by Federal, state, or local agencies.

IV. DESCRIPTION OF SUBBASIN RESOURCES

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Social Characteristics

The population of the subbasin has been slowly increasing for several decades. This increase can be attributed to the growth experienced by Cass County. The rural population, particularly the farm population, in the subbasin has been decreasing while the urban population has increased. The majority of Cass County's population is urban, with Fargo and West Fargo accounting for more than 70 percent of the total. Between 1970 and 1977, Cass County's growth was the result of a substantial natural increase (more births than deaths) and inmigration (six percent). Although the subbasin has no large urban areas, the total population increased from 4,656 in 1970 to 4,822 in 1977, which was a 3.6 percent increase. The population density increased from 9.1 persons per square mile to 9.5 persons per square mile. Approximately 33 percent of the subbasin's population is of Norwegian background. The minority population is too small to be identified.

The largest towns in the subbasin are Hunter and Arthur. Arthur's population was 435 in 1977, which was a 5.6 percent increase over 1970. Hunter's population was 343 in 1977, which was a 5.2 percent decrease from 1970. Communities in the subbasin are primarily rural or agricultural service centers and exhibit a high degree of stability. Approximately 73 percent of the residents in Traill and Steele counties own their own homes. Sixty-nine percent of the 1970 populations in each of the counties occupied the same residence since 1965, and 81 percent still lived in Traill County and 85 percent lived in Steele County. In Cass County, only 59.3 percent of the residents own their homes. Forty-eight percent occupied the same residence in 1965, and 70 percent remained in the county. The urban areas of Fargo and West Fargo are included in Cass County figures and probably do not reflect accurately the stability of rural communities in the Cass County portion of the subbasin. Approximately 70 percent of the Cass County population works in the county of residence. This figure rises to 81 percent for Traill County and 85 percent for Steele County.

Economic Characteristics

Employment

In 1960, the agriculture industry was the dominant employment sector in the counties of Steele and Traill within the subbasin. In Cass County, however, agricultural employment ranked third behind trade and services. The reason for this is that Fargo, the urban center of Cass County, accounts for 89 percent of the county's total employment. The rural areas of Cass County still depended heavily on agriculture for employment. Between 1960 and 1970, agricultural employment in all three counties decreased by more than 40 percent. This decrease resulted from increased mechanization, which allowed farmers to plant larger acreages of crops and to consolidate farms. Although farm employment decreased, other sectors, especially trade and services, increased, and an increase in total employment in the subbasin resulted. Since 1970, the total employment has continued to increase. Subbasin employment in 1970 was 1,583, and in 1977, it was 2,363, which was a 49 percent increase. Again, this increase is due primarily to the existence of Fargo, which heavily affects the county's total employment. Although farm employment has decreased, the subbasin's economy will continue to depend heavily on the agriculture industry. Unemployment during the 1970's averaged six percent. Due to the importance of agriculture in the subbasin, employment is high during the spring and summer growing season and the fall harvesting. During the winter, agricultural activities decrease drastically.

Income

Total personal income for the subbasin increased from $33 million to $42 million between 1969 and 1977 (as expressed in 1979 dollars). Farm income amounts to about half the total personal income, and cash grain sales amount to more than 65 percent of the total farm income. Average per capita income during the same years increased from $7,018 to $8,761, which was more than 20 percent higher than the 1979 average income figure of $6,859 for the whole state.

Business and Industrial Activity

Agriculture

Agriculture is very important to the subbasin's economy, and the production of small grains is the most important agricultural component. Livestock production is more common in the southern portion (Cass County) of the subbasin. Approximately 94 percent (or 306,816 acres) of the subbasin's land area is under cultivation, and only two percent is devoted to pasture. The amount of land in farms has increased over the past two decades because the sale of government-owned land and drainage of lowland areas have made more land available to place under cultivation. Because of farm consolidation, the average size of farms is increasing, and the total number of farms is decreasing. During the 1960's, the number of farms in the subbasin decreased by more than eight percent.

The major crops grown in the subbasin are identified in Table 4. Wheat, which accounts for 36 percent of the harvested acreage, is the leading crop. Barley and sunflowers rank second and third, respectively, and amount to approximately 45 percent of the harvested acreage. Other important crops grown in the subbasin include soybeans, sugarbeets, hay, and oats. The increase in production of sunflowers in the subbasin during the 1970's has paralleled that of the entire state. Between 1977 and 1978, sunflower production in North Dakota increased by more than 50 percent.

Table 4

1978 CROP STATISTICS, ELM RIVER SUBBASIN

Crop	Harvested Acres	Yield Per Acre	Total Production
Wheat	116,640	35.0 bushels	4,082,400
Barley	84,790	54.8 bushels	4,646,492
Sunflowers	61,780	1,567 pounds	96,809,260

Source: Gulf South Research Institute.

Wheat, barley, and sunflowers are grown throughout the subbasin. The counties of Cass and Traill were among the top ten counties in the state in the production of barley and sunflowers. Cass County also ranked third in the production of all wheat for that year. The floodplain of the Elm River is an important agricultural area that is also planted with small grains and sunflowers.

Manufacturing

Three of the four manufacturing establishments in the subbasin are located in the town of Hunter, and the fourth is located in Arthur. There is one newspaper, a grain company, a fertilizer plant, and a company which produces trailers. Manufacturing employment amounts to only two percent of the total subbasin employment. The manufacturing establishments are listed in Table 5 according to their Standard Industrial Classification (SIC) codes.

Table 5

MANUFACTURING ESTABLISHMENTS, ELM RIVER SUBBASIN

SIC	Description	Estimated Employment
27	Printing and Publishing	9
37	Transportation Equipment	9
51	Wholesale Trade--Nondurable Goods	18
TOTAL		36

Source: 1978-1979 Directory of North Dakota Manufacturing.

Trade

In 1977, total trade receipts for the subbasin exceeded $72 million (expressed in 1979 dollars). Nearly 75 percent (or $54.0 million) of the receipts were wholesale trade. Retail trade and selected service receipts were $18.8 million and $2.6 million, respectively, in 1977.

Transportation Network

The subbasin is traversed by two major state highways. Route 18 runs north to south through the towns of Hunter and Arthur and provides

direct access to Interstate 94, a few miles south of the subbasin. State highway 38 traverses the western edge of the subbasin near Page and also provides access to Interstate 94. These routes are important to farmers in the subbasin because they provide fast and efficient access to the nearby urban center of Fargo.

The Burlington Northern Railroad has four rail lines that cross the subbasin and pass through most of the towns. The railroad travels to the city of Fargo. There is a small airport for public use in the town of Arthur, but it contains very limited facilities with no established passenger service.

Land Use

Approximately 94 percent of the subbasin is under cultivation, 2.8 percent is urban, 1.7 percent is pasture, and 0.1 percent is in forest. Water areas amount to only 0.6 percent of the total land area.

Land use in the floodplain of the Elm River does not differ from land use throughout the subbasin. The floodplain is primarily agricultural land, and the small amount of forest areas are located adjacent to the river.

For many years, wetland drainage and the purchase of government-owned land have increased the amount of land in cultivation. This trend has decreased recently, since most of the available land in the subbasin is now being used for agricultural purposes.

Environmental Characteristics

Climate

Climatic conditions vary widely. The recorded temperatures (by the U.S. Weather Bureau Station at Hillsboro) range from $-40^{\circ}F$ to $104^{\circ}F$. The mean length of the freeze-free period ranges from 132 days in the eastern part of Traill County to 125 days in the west. Annual mean precipitation in eastern Traill County is 20.78 inches, and in the west, 19 inches. The annual mean precipitation April through September is 15.5 inches in the east and 14.8 inches in the west. The annual moisture pattern is desirable for the type of agriculture practiced. Occasional periods of excessive rainfall and snowmelt do occur. These periods have necessitated the construction of numerous drains in the flat Red River Valley floor.

Geology

The subbasin lies within the Western Lake Section of the Central Lowlands Province of the Interior Plains physiographic division. Cretaceous deposits of shale and thin limestone forming the Colorado Group and areas of undifferentiated sediments of the Dakota Group overlie Precambrian granite. During the Pleistocene glacial period, clay and silt glacial lake sediments were deposited in the central and eastern portion of the subbasin. Till overlies Cretaceous deposits in the western portion of the area and consists of a heterogeneous mixture of clay, silt, sand, and gravel.

Biology

The potential natural vegetation of the subbasin includes Northern Flood Plain Forest along the Elm River, its tributaries, and the Red River; Bluestem Prairie from near the Red River to a point approximating an imaginary line extending north-south along the Steele-Traill County line; and Wheatgrass-Bluestem-Needlegrass prairie in the remaining western part of the subbasin. Today, most of these communities have been replaced by cropland (94 percent), pastureland (1.7 percent), and urban (2.8 percent) land uses. The remaining forests are found either along streams or in planted shelterbelts and windbreaks. American elm, green ash, willow, boxelder, and cottonwood are the major tree species within stream floodplains. On slopes where mesic conditions prevail, bur oak and basswood predominate. The planted stands consist of both native and exotic species. Little prairie exists within the subbasin; characteristic prairie plants may occur in some pastures, and scattered remnants are found along railroad rights-of-way, highways, cemetaries, and the like. The vegetation consists of such species as big and little bluestem, Indiagrass, prairie dropseed, needlegrass, and wheatgrass (Kuchler, 1964; U.S. Fish and Wildlife Service, 1979; Wanek, 1967).

In comparison with its former distribution, most of the wetlands have been drained and converted to agricultural uses. Remaining potholes and marshes are located primarily in the western portion of the subbasin where rolling and hilly conditions exist that are not as conducive to

farming as the flat lands of the Red River Valley in the east. Wetland types known to occur in the three counties encompassed by the subbasin consist of the following: Type 1--seasonally flooded basins and flats, Type 3--shallow fresh marshes, Type 4--deep fresh marshes, and Type 5--open fresh waters (Traill County Water Management District, 1976; U.S. Fish and Wildlife Service, 1979).

Habitats of importance to wildlife in the subbasin include the limited woodlands, wetlands, and grasslands. The woodlands and brushy areas provide den and nesting sites, territories, winter and escape cover, and winter food for many of the resident and migratory wildlife species in the region. They also furnish a travel corridor for animals moving through the intensively farmed areas of the subbasin. Forests afford breeding and nesting areas for birds and rank second only to wetlands in breeding bird population densities. They contain a greater variety of wildlife species than any other major habitat type. Because of their value as wildlife habitat and the limited amount remaining, there is a need to protect the woodlands of the subbasin. Wetlands furnish breeding, nesting, feeding, and resting areas for waterfowl; breeding and rearing habitat for big and small game, furbearers, and other wildlife such as passerine and wading birds; spawning and nursery areas for fishes and aquatic invertebrates; and a high-yield food source for many resident species. As indicated above, they rank first in breeding bird densities, with average populations reported at 337.0 pairs/km^2. Native grasslands or prairie, when found in combination with wetland complexes, form a dynamic and varied ecosystem which supports diverse and abundant populations of birds, mammals, invertebrates, and plants. Average breeding bird densities of 142.7 pairs/km^2 have been recorded in this highly productive community. Like the woodlands, both the remaining wetlands and prairies of the subbasin need to be protected, conserved, and enhanced wherever possible (U.S. Wildlife Service, 1979, 1980).

The white-tailed deer is the important big game animal of the subbasin. Population densities are high along the Red River and the North Branch and main stem of the Elm River west of Grandin, with <1.5 deer/square mile; the remaining areas have low densities (<0.5 deer/square mile). Small

game mammals of importance include the fox and gray squirrel in the wooded areas and the cottontail. Waterfowl production is low in the heavily farmed area of the Red River Valley, with <4.0 breeding pairs/square mile, and medium in the western portion, with 4.0-9.0 pairs/square mile. The most common breeding ducks are the mallard, blue-winged teal, northern shoveler, and gadwall. Wood duck production will be low since riparian woodlands are limited.

The Hungarian partridge is the principal upland game bird, with moderate densities (12-31 birds/1,000 miles of rural mail carrier route) in the north half of the subbasin and low population levels in the southern half (<12 birds/1,000 miles). Pheasant densities are moderate throughout the area at 1.0-10.0 hens/square mile. Low population levels of sharp-tailed grouse, <3.0 sharptails/square mile, prevail in the subbasin. The common furbearers are the mink, muskrat, beaver, red fox, raccoon, and skunk. Red Fox densities are moderately low (5.0-8.9 families/township) in the eastern portion and moderately high (9.0-13.0 families/township) in the western part (data from North Dakota Game and Fish Department in U.S. Fish and Wildlife Service, 1979). Table 6 shows harvest data for many of the game and furbearing species mentioned above in Traill and Cass counties from 1970-1975.

More than 200 species of birds may occur in the subbasin. A total of 113 species are known to breed in the Agassiz Lake Plain Region and 148 species in the Prairie Pothole Region. Characteristic breeding birds include the savannah sparrow in croplands, mourning dove in shelterbelts, brown-headed cowbird in grasslands, yellow warbler in thickets, red-winged blackbird in wetlands, and American robin in forests. Approximately 30 nongame mammals occur such as the red bat, Gapper's red-backed vole, house mouse, and meadow jumping mouse. About 15 species of amphibians and reptiles may be found, such as the Great Plains toad, leopard frog, and red-sided garter snake (Stewart, 1975; Willis, 1977).

The Elm River drains an area of approximately 330 square miles. The North and South branches are the main tributaries of the Elm River. Most of the streams or reaches within the streams have been channelized, which has resulted in the degradation of the streams' water quality (U.S. Army Corps of Engineers, no date).

Table 6

HARVEST DATA FOR GAME AND FURBEARING ANIMALS IN TRAILL AND CASS COUNTIES, 1970-1975, ELM RIVER SUBBASIN

Species	Number Harvested[a]					
	1970	1971	1972	1973	1974	1975
Red Fox (trapped and hunted)	79 (159)	502 (1,014)	438 (885)	1,159 (2,343)	542 (1,096)	671 (1,356)
Coyote (trapped and hunted)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	1 (2)
Sharp-tailed Grouse	0 (172)	78 (312)	0 (57)	0 (95)	0 (0)	0 (48)
Ring-necked Pheasant	90 (493)	0 (893)	64 (1,252)	150 (1,278)	141 (992)	0 (727)
Cottontail	1,043 (2,719)	67 (2,426)	477 (2,532)	611 (8,079)	807 (2,177)	963 (1,712)
White-tailed Deer	99 (200)	278 (562)	227 (458)	311 (628)	200 (404)	206 (417)
Hungarian Partridge	794 (794)	127 (1,018)	323 (1,831)	890 (3,050)	650 (3,147)	548 (1,390)
Fox Squirrel	746 (3,412)	447 (3,434)	909 (3,260)	1,508 (5,290)	573 (3,588)	1,776 (1,659)

[a]Numbers in parenthesis are for Cass County; those outside of parenthesis are for Traill County.

Source: North Dakota Game and Fish Department in U.S. Fish and Wildlife Service (1979).

The Elm River has been listed as a Class III stream. The lower reaches of this stream support a moderate forage fish production and a moderate sport fishery of walleye, northern pike, freshwater drum, and goldeye. Channelization, streambank clearing, and agricultural runoff has degraded the water quality which, in turn, lowers the fishery value. The North Branch of the Elm River supports only a moderate forage fish production and no sport fishery. The South Branch has only a limited forage fish production. These two reaches have been designated as Class IV streams. The same problems associated with the reduced value of the Elm River are the reasons these reaches have a very limited productivity (U.S. Fish and Wildlife Service and North Dakota Game and Fish Department, 1978).

Northern pike, walleye, goldeye, and freshwater drum are the only sport fishes found in this subbasin, and these are limited in numbers. Common rough and forage fish reported from the subbasin include fathead minnow, carp, creekchub, common white sucker, and brook stickleback (Copes and Tubb, 1966). The Elm River was not included in Cvancara's (1970) survey of the mussels of the Red River Valley.

Water Supply

Four of the communities in the subbasin have municipal water supplies and all rely on groundwater. The Page aquifer, utilized by the city of Page and surrounding farms, has a large, undeveloped potential. The North Dakota State Department of Health reports Page as having an annual consumption rate of approximately 12,775,000 gallons. Relatively minor water quality problems exist in Arthur. Arthur uses about 11,680,000 gallons per year. The city of Hunter has no apparent water supply problems and consumes approximately 17,520,000 gallons annually. Future water requirements for the subbasin should be met without difficulty.

Water Quality

A very limited amount of water quality data is available for the Elm River. Hoisveen (1976) reported an observation station on the Elm River at Grandin, but it has since been terminated. Data collected from

this station indicated that the dissolved oxygen content ranged between 8.1 mg/l (milligrams per liter) to 13.2 mg/l. The TDS levels varied from a low of 810 mg/l to a high of 1760 mg/l (Hoisveen, 1976). Excessive nitrate concentrations from nonpoint agricultural sources create water quality problems which impair fish propagation in the river. The Elm River is designated as a Class II stream with intermittent flow. The water quality of this stream is generally considered to be poor (North Dakota Statewide 208 Water Quality Management Plan, 1978).

Table 7 presents the groundwater quality data from three communities within the subbasin. Several aquifers are found in the area which produce adequate quantities. However, the quality of these aquifers is normally poor, with average TDS levels over 1000 mg/l. The water produced from these aquifers is also normally very hard and contains high levels of iron and sulfates (Hoisveen, 1976).

Table 7

GROUNDWATER QUALITY DATA FROM THREE COMMUNITIES WITHIN THE ELM RIVER SUBBASIN

Parameter	Arthur	Hunter	Page
Total Dissolved Solids (TDS)	1,136	816	768
Hardness ($CaCO_3$)	225	690	460
Iron	0.6	0.0	0.0
Manganese	Trace	Trace	0.5
pH (Standard Units)	7.6	7.2	7.9
Sodium	280	20	29
Fluoride	0.4	0.2	0.3
Chloride	100	Trace	1
Sulfates	330	50	180
Nitrates	22	4	3

Source: North Dakota State Department of Health, 1964.

Aesthetics

There is a severe lack of natural or artificial water bodies or forest tracts within the subbasin. Many people consider water and forests as the environmental prerequisites for aesthetically pleasing areas.

Most of the land in the subbasin has been cleared for agricultural purposes. Water quality problems as a result of agricultural runoff and previous channelization projects have diminished the aesthetic and recreational potential of the Elm River and its tributaries.

Cultural Elements

The availability of the subbasin to prehistoric inhabitants was severely restricted by glacial Lake Agassiz. For sometime after the gigantic Pleistocene lake retreated, the flat lacustrine plain of the Elm River Subbasin was poorly drained, swampy, and inhospitable to humans. One should expect, therefore, that only sites of a late-prehistoric cultural context would characterize the subbasin.

Archeological research in the subbasin is virtually non-existent. No archeological surveys have been conducted, and no sites have been recorded in the three county area which comprises the subbasin. Surface indications of many archeological features could, however, have been destroyed through intensive and prolonged agriculture. It is reasonable to expect that subsequent field reconnaissances will yield evidence of prehistoric man. Archeological resources can be expected to occur along the Elm River itself.

Historically, the subbasin was occupied by the Cheyenne and Yanktonai (Dakota) Indians. The Cheyenne Indians may have passed through the subbasin vicinity in the late 18th century, sometime before their transition to a nomadic Plains Indian culture (see Robinson, 1966:25; Strong, 1940:370; Hewes, 1948:52).

The study area was settled in the 1870's by persons of predominantly Norwegian descent. Today, most of the subbasin is under culvitation by the descendents of the original pioneers. There are no sites listed or eligible for listing on the National Register at this time.

Recreational Resources

Recreation resources are severely limited within the subbasin. There are only eight sites (comprising approximately 164 acres) used for recreation purposes in the subbasin listed in the 1979 North Dakota Inventory of Recreational Facilities. There are only two sites with more than 15 acres:

Augustadt Dam near Clifford and Hunter Park, as illustrated in Figure III. These two sites represent 82 percent of the total recreational lands in the subbasin. An inventory of existing facilities at these sites is included in Appendix B of this report. Additional recreational resources in the subbasin are limited to very small municipal parks and athletic fields which average four acres in size and provide limited opportunities for residents to pursue non-water based recreational activities.

Fishing is limited in the subbasin because of the lack of reservoirs of sufficient depth to support fishery populations. The Elm River is also shallow, and fishery resources are limited by fish kills.

Hunting is restricted in the subbasin because so much of the natural habitat supporting wildlife and waterfowl has been cleared for agricultural purposes.

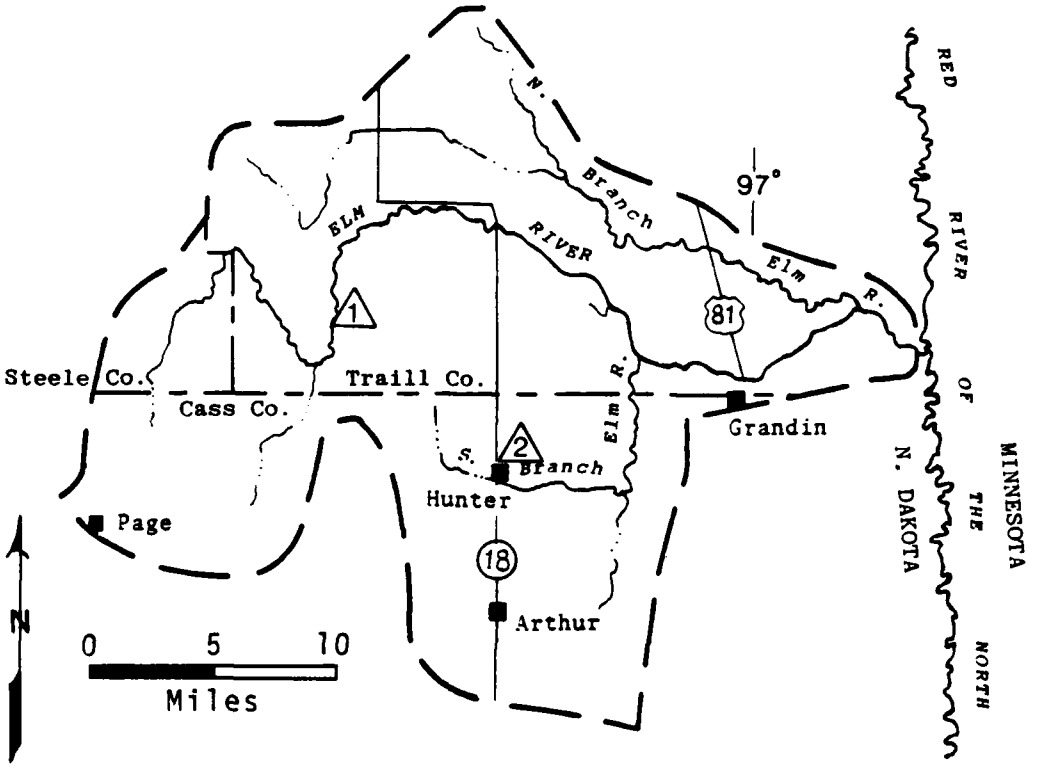
Significant Environmental Elements

Social

Arthur, Hunter, and Page are the population centers in the subbasin. Several flood control projects have been implemented by the Soil Conservation Service and by state, county, and private interest. These have provided substantial protection from floods. The towns are primarily agricultural service centers. Flooding problems result in damages to low-lying residential areas and commercial establishments. Transportation facilities and utilities area also damaged. Agricultural losses from delays in planting, damages to crops, reduced yields, and costly repairs to farm structures and equipment. The towns may suffer indirect economic losses related to losses experienced by the agricultural sector.

Cultural

To date, few archeological sites have been identified. However, potentially significant cultural resources might be located and identified with systematic field work. No sites are listed on the National Register of Historic Places, but a systematic search would probably locate some sites potentially eligible for nomination.



△ EXISTING RECREATION AREAS

1 Angustadt Dam
2 Hunter Park

Source: Gulf South Research Institute.

Figure III. RECREATIONAL RESOURCES

Soils

The Elm River Subbasin contains numerous soil associations. The most predominent soils in the western section are the Barnes-Svea associations. These are deep, nearly level to undulating, well-drained and moderately well-drained, medium textured soils formed in fine loamy glacial till. The Embden-Glyndon-Tiffany soils have similar characteristics, but they are somewhat poorly drained, and some have a large amount of lime at shallow depths. Fargo-Hegne soils are deep, nearly level, poorly drained and fine textured. These soils were formed in clayey lacustrine sediments, and some have large amounts of lime at shallow depths. The glacial till plains contain Gilky-Lankin soils that are like the other but were formed in coarse, silty lacustrine sediments and underly fine loamy glacial till. High lime content at shallow depths is also a problem in these soil areas. Throughout the subbasin, these soil associations are used almost entirely for cropland.

Water

There are less than 2,000 acres of water area in the subbasin, and there are no lakes of appreciable size. The main water features are the Elm River and its tributaries.

Woodlands

The woodlands and brushy areas of the subbasin are significant because of their high value as wildlife habitats and because of their limited areal extent. Land use data show that only 0.1 percent (326 acres) of the total area in the subbasin (326,400 acres) is forested. Thus, there is need to protect, conserve, and enhance this major habitat type within the subbasin's limits.

Wetlands

The wetlands of the subbasin are significant because of their many beneficial uses and values as habitats for flora and fauna, waterfowl production, water storage during spring runoff and periods of extreme precipitation, groundwater recharge, sediment traps, and nutrient traps (Cernohous, 1979; U.S. Fish and Wildlife Service, 1979; E.O. 11990, dated 24 May 1977). They are also significant because of the limited amount

remaining, as compared to their original number and acreage, and should be conserved and enhanced where possible.

Table 8 gives the number and areal extent of wetlands in the North Dakota counties included by the subbasin. The figures were obtained during a 1964 inventory based on a 25 percent sampling of the wetlands within these counties. The number and acreage of all Types 3, 4, 5, 10, and 11 wetlands were multiplied by four to expand the 25 percent sample to 100 percent. Type 1 wetlands were not measured in the 1964 survey. The number and acreage of Type 1 wetlands, however, were estimated based on previous studies which indicated that they comprise about 60 percent of total wetland numbers and 10-15 percent of the total wetland acres in the Prairie Pothole Region. Although no acreage figures are available for wetlands drained and converted to cropland, most have been drained in eastern North Dakota. Current annual wetland drainage estimates are thought to be less than two percent of the remaining wetland base, except in isolated areas where it may be higher (U.S. Fish and Wildlife Service, 1979).

As of 1964, a total of 11,339 wetlands comprising 23,261 acres remained within the three counties encompassed by the subbasin's limits.

Waterfowl Production Areas

Waterfowl Production Areas (WPAs) are wetland areas that the U.S. Fish and Wildlife Service (USFWS) has either acquired through fee title, or obtained an easement interest to preserve valuable breeding, nesting and feeding habitat for migratory waterfowl. These wetland areas are purchased, or an easement interest obtained, with funds received from the sale of migratory bird hunting and conservation stamps (Duck Stamps). These WPAs are significant because they provide the public with a great variety of wildlife-oriented recreational opportunities, as well as providing valuable habitats for migratory waterfowl and many other forms of wildlife. USFWS is responsible for the compatibility determinations (uses) and the issuance and denial of permits involving these lands. WPAs acquired in fee titles are managed for optimum wildlife production, particularly waterfowl. On easement WPAs, the rights acquired are limited to the burning, draining and filling of wetland basins and the right of access.

Table 8

1964 WETLAND INVENTORY DATA FOR THE THREE COUNTIES INCLUDED BY THE ELM RIVER SUBBASIN

			Wetland Types[a]							
County	Number[b]	Acres[c]	Number	Acres	Number	Acres	Number	Acres	Number	Acres
Traill	25	127	38	471	4	376	-0-	-0-	67	974
Cass	411	414	646	1,938	39	823	-0-	-0-	1,096	3,175
Steele	3,816	2,493	5,885	11,123	435	3,832	40	1,664	10,176	19,112
TOTAL	4,252	3,034	6,569	13,532	478	5,031	40	1,664	11,339	23,261

[a]Type 1 = Seasonally flooded basins and flats
Type 3 = Shallow fresh marshes
Type 4 = Deep fresh marshes
Type 5 = Open fresh water

[b]Calculated at 60 percent of total wetland numbers.

[c]Calculated at 15 percent of total wetland areas.

Source: U.S. Fish and Wildlife Service, 1979.

All other property rights remain with the landowners. The approximate locations of the WPAs acquired in fee within the subbasin are shown in Figure IV. Total acreage of these WPAs, fee and easement, within this subbasin are given in Table 9.

Wildlife Management Areas

Wildlife management areas are important because of the opportunities provided for outdoor recreation and the protection and management given to biological resources within their boundaries. A listing of the areas and their respective acreages and location were presented in the Existing Conditions section under the recreation discussion.

Threatened or Endangered Species

Two mammals considered endangered in North Dakota have been reported from Traill County: (1) black bear and (2) river otter. The black bear prefers extensive stands of forests. The river otter inhabits the borders along streams and lakes. The exact reason for the decline of both species is unknown; however, it is presumed that hunting and trapping pressures coupled with the loss of suitable habitat are the primary reasons. The bald eagle and American peregrine falcon are endangered birds that do not breed in the area but include the subbasin within their migratory flyways (McKenna and Seabloom, 1979).

Other Important Species

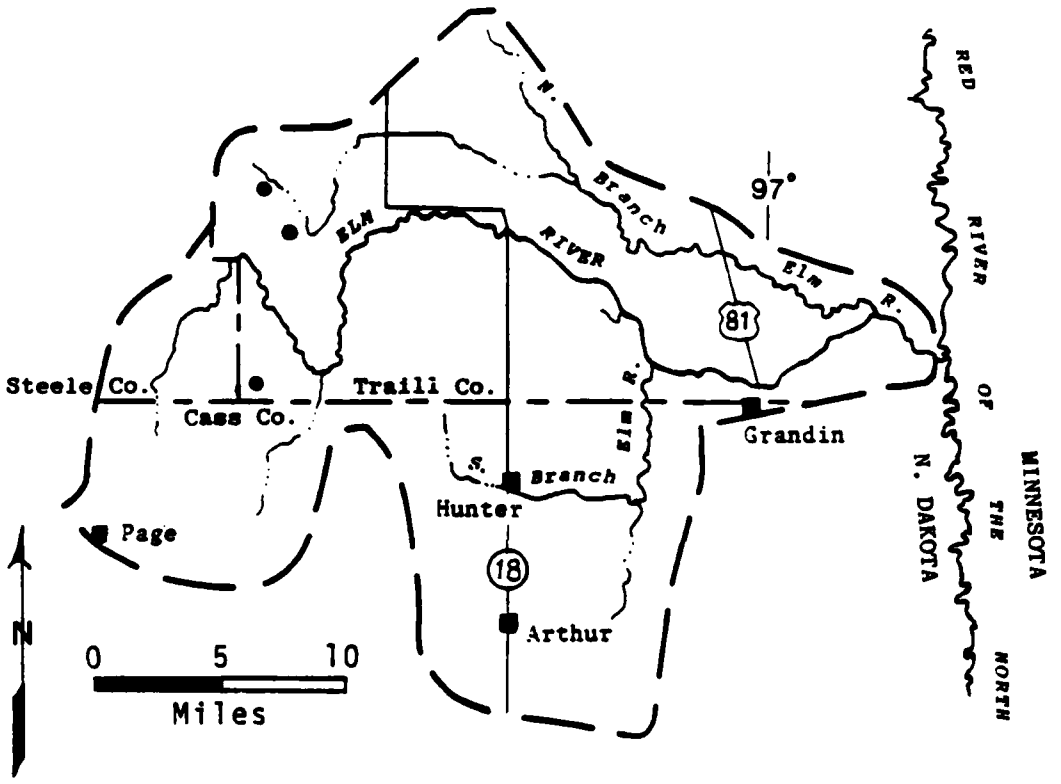
The only species of special importance that has been reported from the subbasin is the prairie skink. This is a peripheral species that is restricted to open grassy areas with sandy soils (McKenna and Seabloom, 1979).

Rare and Unique Plants

According to Barker, et al. (1976), no rare or unique plant occurs within the subbasin.

Natural Areas

No natural areas have yet been established with the subbasin (Kantrud, 1973).



● WATERFOWL PRODUCTION AREAS (Fee Tracts)

*Exact locations and numbers of Waterfowl Production Areas are on file at the U.S. Fish and Wildlife Service, Area Office, Bismarck. No copies of these maps have been published or released but can be reviewed at the above office.

Source: State Comprehensive Outdoor Recreation Plan, 1975.

Figure IV. WATERFOWL PRODUCTION AREAS

Table 9

WATERFOWL PRODUCTION AREAS (WPAs) AND WETLAND EASEMENT AREAS OF THE COUNTIES INCLUDED IN THE ELM RIVER SUBBASIN

County	WPAs (Acres)	Wetland Easement Areas (Acres)	Total Acres
Cass	3,187	1,567	4,754
Steele	3,570	3,734	7,304
Traill	719	239	958
TOTAL	7,476	5,540	13,016

Source: U.S. Fish and Wildlife Service, Fee and Easement Interests in Real Property, 1979.

V. FUTURE CONDITIONS

V. FUTURE CONDITIONS

The following description of the subbasin's "most probable" and "without project" future conditions and resources focuses on economic aspects, population projections, and generalized environmental conditions and resources.

Most Probable Economic Conditions

According to the Principles and Standards, specifications of future conditions should reflect OBERS Series E and E' projections as a basis, unless conditions unique to the study area dictate that OBERS may not be totally satisfactory. Projections of general economic and demographic indicators for the non-SMSA portions of the Fargo-Moorhead area appear to be underestimated, since they project steady decreases throughout the study period. Therefore, Gulf South Research Institute (GSRI) developed figures have been adopted as most probable. OBERS E and E' projections have, however, been designated as most probable for per capita income and future agricultural activities.

Data presented in Table 10 depicts population, employment, and per capita income (expressed in 1979 dollars) figures.

Table 10

ELM RIVER SUBBASIN, POPULATION, EMPLOYMENT, AND PER CAPITA INCOME PROJECTIONS, 1980-2030

Parameter	1970	1977	1980	1990	2000	2010	2020	2030
Population	4,656	4,822	5,000	5,200	5,400	5,600	5,800	6,000
Employment	1,583	2,363	2,400	2,500	2,700	2,900	3,000	3,200
Per Capita Income (Dollars)	7,018	8,761	10,600	13,800	17,900	23,300	30,300	39,400

Sources: U.S. Water Resources Council, 1972 OBERS Projections, Series E; and Gulf South Research Institute.

These figures reflect a slight reversal during the past decade of historic population and employment decline trends. This reversal has resulted largely from the stabilization of agricultural employment. Per capita income is forecast to rise at the rate set for the non-Standard Metropolitan Statistical Area (SMSA) portion of the Bureau of Economic

Analysis (BEA), i.e. some three percent per annum. None of the three principal towns in the area (Arthur, Page, and Hunter) are expected to play major economic roles, expect by providing a small manufacturing base. Spin-off effects from the Fargo metropolitan area will be the main factors influencing this subbasin's growth.

Most Probable Agricultural Conditions

Approximately 306,800 acres within the subbasin are currently under cultivation, and wheat, barley and sunflowers are principal crops produced. The total production of these three principal crops alone is estimated to be worth $31.0 million in 1980 (using October 1980 Current Normalized Prices for North Dakota). This total value of production figure is projected to increase to $52.0 million (using October 1979 Current Normalized Prices for North Dakota). Projected production of these three principal crops is presented in Table 11.

Table 11

ELM RIVER SUBBASIN, PRINCIPAL CROPS AND PROJECTED PRODUCTION, 1980-2030
(Production in Thousands)

Year	Wheat (Bushels)	Barley (Bushels)	Sunflowers (Pounds)
1980	4,025	4,786	99,714
1990	4,669	5,552	115,668
2000	5,313	6,318	131,622
2010	5,716	6,796	141,594
2020	6,118	7,275	151,565
2030	6,762	8,040	167,520

Sources: OBERS Series E'; and Gulf South Research Institute.

Evaluation of Flood Damages-Future Conditions

A summary of present and future average annual flood damages is presented in Table 12. Using a discount rate of 7 1/8 percent, equivalent average annual damages are $202,100. Urban damages were reported to be minor, and rural damages account for 100 percent of the aforementioned figure.

Table 12

ELM RIVER SUBBASIN, SUMMARY OF PRESENT AND FUTURE AVERAGE ANNUAL DAMAGES URBAN, AGRICULUTRAL, AND TRANSPORTATION (October, 1979 Prices, 7 1/8 Percent Interest)

Category	Flood Damages						Increase 1980-2030	Average Annual Equivalency Factor	Average Annual Equivalency of Increase	Equivalency Average Annual Damages
	1980	1990	2000	2010	2020	2030				
Urban	*	*	*	*	*	*	*	--	*	*
Agricultural										
Crop	125,900	146,000	166,200	178,800	191,400	211,500	85,600	0.2903	24,800	150,700
Other Agricultural	42,000	45,400	48,700	50,800	52,900	56,300	14,300	0.2903	4,200	46,200
Transportation	5,200	5,200	5,200	5,200	5,200	5,200	--	--	--	5,200
TOTAL	173,100	196,600	220,100	234,800	249,500	273,000	99,900	0.2903	29,000	202,100

*Average annual urban damages were reported to be minor for the Elm River Subbasin in the Red River of the North Basin Plan of Study, April, 1977.

Source: Gulf South Research Institute.

Flood damages to residences, businesses, industrial structures, churches, schools, automobiles, house trailers, public property and contents are included in the urban damages category. Damages to streets and utilities (including water, gas, electricity, sanitary sewers, storm sewers, and telephone systems) are also taken into consideration. This category also includes loss of wages, loss of profits, expenditures for temporary housing, cleanup costs, and extra expenses for additional fire and police protection and flood relief.

Agricultural flood damages consist of crop and pasture damage, which may include costs of replanting, refertilizing, additional spraying, reduced crop yields, loss of animal pasture days, and other related flood losses.

Other agricultural damages consist of land damage from scour and gully erosion and deposition of flood debris; livestock and poultry losses; damages to machinery and equipment, fences, and farm buildings and contents (excluding residences); and damages to irrigation and drainage facilities.

Transportation damages include all damages to railroads, highways, roads, airports, bridges, culverts, and waterways not included in urban damages. In addition, all added operational costs for railroads and airlines and vehicle detours are included.

Agricultural crop flood damages were projected to increase at the same rate as crop income projections published in the 1972 OBERS Series E projection report. These crop income projections were prepared by the U.S. Economic Research Service (ERS) for the Red River of the North region. Other agricultural flood damages were projected to increase at one-half of this rate.

Transportation damages are not expected to change throughout the project life because of the long-term economic life associated with such structures as bridges, railways, roads, and culverts. In addition, it has been found that repairs to these types of structures rarely exceed the cost of a new structure, even with frequent flooding.

Most Probable Environmental Conditions

Water quality improvements will occur with successful implementation of point and nonpoint source pollution abatement plans. The nonpoint source program is expected to take substantially longer to implement. These improvements will benefit both aquatic biota and wildlife.

Acreages of native woodlands and wetlands are expected to decrease with continued conversion to croplands, pasturelands, and other land uses. Some offset of woodland losses may result with increased plantings of shelterbelts and greenbelts; however, these plantings may or may not be of comparable quality. A decrease in woodlands and wetlands will result in diminishing populations of plants and animals dependent wholly or in part upon these communities.

Without Project Conditions

It is anticipated that conditions that will prevail over the 50-year planning period in the absence of a plan to alter resource management procedures will be the same as those set forth previously under the most probable future scenario.

VI. EXISTING FLOODPLAIN MANAGEMENT PROGRAMS

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Institutions

The development of effective water resources management practices in the subbasin is affected by a large number of Federal, state, and local agencies involved in project planning and implementation. There are 44 Federal agencies with various types of jurisdictions, and 14 directly involved in the water and related land resource planning process. At the state level, seven agencies are involved. There are also regional commissions, county agencies, and municipal entities. Differences in perspective and problems of coordination hamper the effective and speedy resolution of problems.

Water resources development is restricted in the subbasin by the lack of a unified resource management program. There are two water management districts representing Traill and Steele counties. The districts have broad powers relating to water resource management interests in the subbasin. The Traill County district is one of only two water management districts in North Dakota that has developed an overall water management program. The plan, however, includes only a portion of the subbasin. There is currently no overall plan that considers the flooding problems of the subbasin as a single hydrologic unit. There are also two soil conservation districts (representing Traill and Steele counties) with authority in the subbasin.

The primary Federal agencies with jurisdiction in the subbasin include the Corps of Engineers and the Soil Conservation Service (SCS). The Corps of Engineers has not developed flood control measures in the subbasin; however, SCS completed a flood control project for the Elm River Watershed in 1971. This project provided substantial flood protection for residents. Any additional flood control planning for the subbasin should include the Corps of Engineers, SCS, the North Dakota State Water Commission, and the two water management and soil conservation districts with jurisdiction in the subbasin. It should be noted that the subbasin is included in the Lake Agassiz Regional Council planning district. The Council has developed an overall land use plan which includes the subbasin.

Structural Measures

Under the authority of Public Law-56, the Soil Conservation Service (SCS), in cooperation with local interests, has completed the Elm River Watershed Project in Traill, Steele, and Cass counties, North Dakota. This project included both land treatment and structural flood protection measures. Other structural measures for flood control include a limited number of private, county and state drainage ditch and channel projects. The Corps of Engineers has no existing or planned water resources projects in this subbasin. The locations of existing floodwater control and agricultural management (drainage) measures included in the SCS project are shown in Figure V.

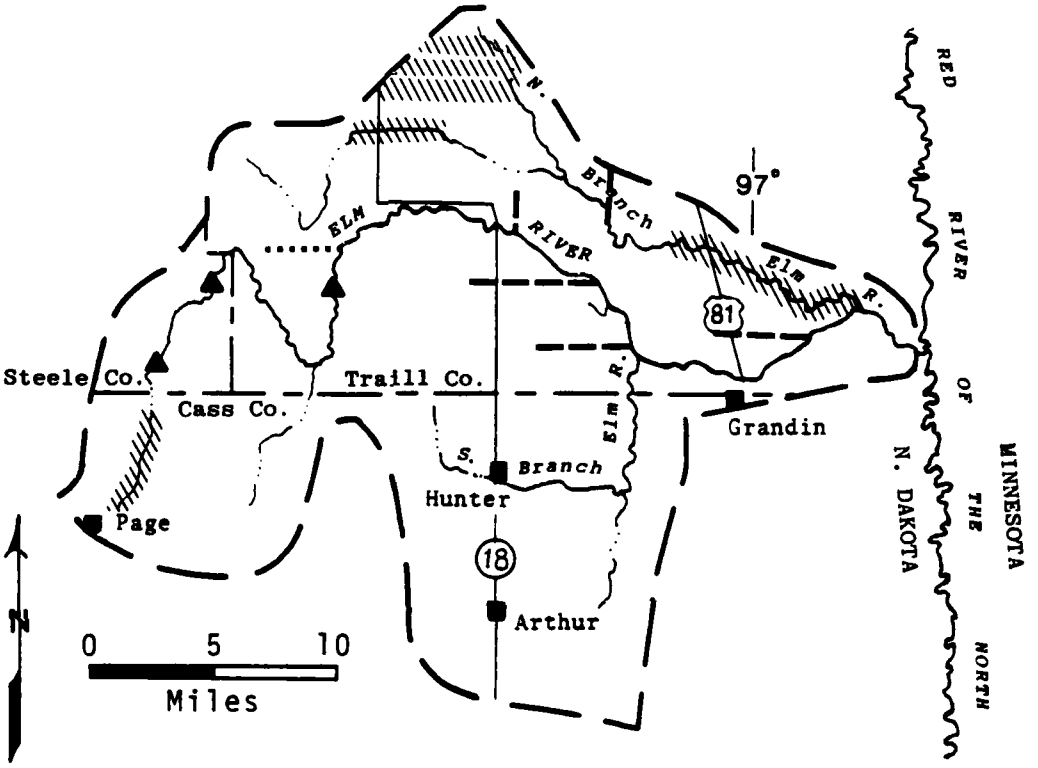
The Elm River Watershed Project was completed in 1971 and includes 60 miles of floodways and channel diversions, 17 grade stabilization structures, and three floodwater retarding structures with a total flood storage capacity of 8,053 acre-feet. The area of this watershed is 346 square miles, which is 68 percent of the subbasin area.

Nonstructural Measures

Nonstructural flood control measures are measures that reduce or eliminate flood damages through procedures that involve little if any construction efforts. Typically, these types of measures will include flood warning and emergency protection, floodplain zoning and regulation, flood insurance, flood proofing, and floodplain evacuation. These measures are primarily applicable to urban areas.

Average annual urban damages are reported to be minor, and existing information does not indicate that substantial urban flood damages are probable in the subbasin.

The towns in the subbasin participate in the Red River Valley flood warning system. The flood warning system for the Red River Valley is a cooperative network organized by the National Weather Service in Fargo, North Dakota. Fifty volunteers throughout the basin report to the National Weather Service on a weekly basis during winter and fall and on a daily basis during spring and summer. The reportage covers all precipitation of 0.1 inch or more, including amounts of snow and water equivalent.



—— Subbasin Boundary

EXISTING AND AUTHORIZED PROJECTS

\\\\ SCS Channel Improvements

—— SCS Floodway

•••• SCS Diversion channel

▲ SCS Reservoir

Source: Gulf South Research Institute.

Figure V. EXISTING FLOOD CONTROL MEASURES

This information is transmitted to the River Forecasting Center in Minneapolis, where it is run through a computer system to determine probable flood stages. The predictions are then transmitted to the National Weather Service in Fargo, which releases them to the public through the news media. Communities are then able to engage in emergency actions to protect themselves from flood damages. Contacts with local officials indicate the flood warning system generally works quite well in the subbasin.

Floodplain regulation and flood insurance are currently required by Federal policies and encouraged by the state of North Dakota. Floodplain regulation is the regulation of any new developments in existing floodplain areas, thereby preventing or reducing future flood damages. However, since home and business owners in flood prone areas can obtain structural improvement loans through the purchase of flood insurance, and because the value of the contents of these structures is expected to increase, flood damages will increase in the short-run even with floodplain regulations in effect.

There are other types of measures that could be implemented in the subbasin to reduce flood damages but that are not directly applicable to urban areas. These measures would include such things as land treatment programs, use of present drainage ditches for floodwater storage, and use of natural areas for reversion to water retention use. Land treatment is used by some farmers in the subbasin, but the Soil Conservation Service has not been called upon to undertake a large-scale program. Present drainage ditches are not used for floodwater storage, and no plans have been developed for future use.

Information on natural storage areas and potentialities for increased storage is limited. There are indications, however, the wetlands play a large role in controlling runoff, especially in combination with good land treatment practices. Valves on storage have averaged about 12 inches per surface-acre of wetlands and have ranged to four times that amount (Cernohous, 1979). The amount of wetland habitat within the watershed area (or subbasin) is important: statistical studies indicate that in certain situations if a watershed has 15 percent of its area in wetlands or lakes, peak floods will be 60 to 65 percent lower than they would

be in the absence of the wetland/lake area; if wetlands or lakes occupy 30 percent of the watershed, there will be a further reduction in flood peaks up to about 75 or 80 percent (Scientists' Report, National Symposium on Wetlands, 1978).

Adequacy of Existing Measures

Flood protection measures in the Elm River Watershed Project provide a substantial reduction in flood damages in this subbasin. Flood probablity vs. discharge curves were derived for this subbasin for the conditions "with" and "without" SCS reservoirs. The reservoirs reduce the one percent (100-year) flood discharge at the Red River of the North from 11,440 cfs to about 7,300 cfs, a 36 percent reduction. Overall, the watershed project provides the entire subbasin with about eight percent (12.5-year) flood protection. The Souris-Red-Rainy River Basins Comprehensive Study states that "Upon completion of the Elm River watershed project now underway, no significant flood damage reduction needs will remain in the Elm River Subbasin". Since this project was completed in 1971, present structural flood control measures provide adequate flood protection for this subbasin.

VII. CRITERIA AND PLANNING OBJECTIVES

VII. CRITERIA AND PLANNING OBJECTIVES

Floodplain Management Criteria

Technical, economic, and environmental criteria must be considered when formulating and evaluating alternative floodplain management measures for the subbasin.

The technical criteria used in formulating and evaluating alternatives for this report consisted of the application of appropriate engineering standards, regulations, and guidelines.

Economic criteria entailed the identification and comparison of benefits and costs of each measure. Tangible economic benefits must exceed costs; however, in certain instances, considerations of approporiate gains in the other accounts (environmental quality, social well-being and regional development) could alter this requirement. All alternatives considered are scaled to a design which optimizes benefits. Annual costs and benefits are based on an interest rate of 7 1/8 percent and price levels and conditions existing in October 1979. A 50-year amortization schedule is used for the features considered.

Environmental considerations call for the formulation of measures that minimize objectionable or adverse environmental effects and maximize environmental benefits. Also, limited consideration was given to modifications based on coordination with state and Federal agencies, local interests, and citizen groups.

Planning Objectives

The primary planning objective of this study was to contribute to flood reduction needs in the subbasin and thereby provide protection from or reduction of flood losses. In conjunction with this economic objective, the study attempted to develop contributions to the environmental quality of the subbasin.

The development of planning objectives involved a broad-range analysis of the needs, opportunities, concerns, and constraints of the subbasin from the information that was available. On the basis of this analysis of the problems, needs, and desires that could be identified, the following planning objectives were established:

1. Contribute to protection from and prevention, reduction, or compensation of flood losses for the flood prone areas of the subbasin during the period of analysis.

2. Contribute, to the maximum extent possible, to the preservation of the quality of the existing riverine environment and enhance the environmental potential of the subbasin as a whole.

3. Contribute to the enhancement of recreational opportunities throughout the subbasin.

4. Contribute to the improvement of water quality in the streams of the subbasin.

5. Contribute to the improvement of water supply, particularly with respect to quality problems in the supply systems.

6. Contribute to the reduction of wind and water erosion throughout the subbasin.

7. Contribute to the development of increased irrigation throughout the subbasin.

8. Contribute to the reduction of wastewater management problems, particularly insofar as they relate to water quality.

VIII. FORMULATION OF ALTERNATIVE MEASURES

VIII. FORMULATION OF ALTERNATIVE MEASURES

This section discusses management measures that have been identified to satisfy the resource planning objectives. Prime consideration was given to the resolution of flooding problems in the formulation of measures. Measures to satisfy the other planning objectives were considered exclusively as components of the flood control measures. In view of the fact that present structural measures significantly reduce average annual flood damages, the following measure was devised in response to the remaining flood control planning needs in the subbasin:

> Construction of farmstead levees around individual farmsteads in the one percent floodplain. These levees would protect individual farmsteads from the one percent flood and could be constructed by the SCS, Corps of Engineers or private interests.

Engineering Methodology

Information used as a base in this analysis was extrapolated from prior studies and reports. There is no existing hydrological nor stream flow data available for this subbasin. In order to estimate the degree of flood protection afforded by the SCS reservoirs, stream flow data for the Goose River at Portland, North Dakota (517 square mile drainage area) and the reservoir storage capacity unit developed in the Forest River Subbasin analysis were used. This analysis was based on floods in the Elm River subbasin occurring independently of flooding caused by Red River backwater and/or overland flooding from other streams.

The farmstead levee alternative is based on data obtained from studies by the Corps of Engineers.

Nonstructural Measures

Among the nonstructural measures considered in similar subbasins were flood warning and forecasting services, emergency protection, permanent floodplain evacuation and flood proofing. These measures are discussed in the following paragraphs.

Floodplain regulation and flood insurance are currently required by Federal policies and encouraged by the State of North Dakota. These measures primarily consist of regulating new developments in existing

floodplain areas and the insuring of affected property owners for losses sustained through flooding, thereby complying with the criteria necessary for persons living in these floodplains to be eligible to participate in the flood insurance program. Floodplain regulation should be a part of any flood protection system and could be effective in these communities and rural areas. As a supplement to floodplain regulation, flood insurance can provide limited protection to existing developments. In the long-run, floodplain regulation would theoretically eliminate all nonconforming floodplain structures, thereby reducing flood damages.

Unsubsidized crop insurance is available through the U.S. Department of Agriculture Federal Crop Insurance Program, which covers all natural disasters including floods. However, actual crop damages could be reduced only to the extent that intensive farming practices would be discouraged in the long-run in the floodplain. Because of the highly productive nature of floodplain farming, it is very doubtful that any long-term shifts away from the intensive farming of floodplain areas would occur.

Flood warning and forecasting services in conjunction with emergency protection measures have been used with reasonable success. Evacuation is possible due to the prolonged nature of the rise flood in waters from major flood events; but, particularly in the case of summer floods, time would not permit the erection of emergency flood protection works. Because of the broad extent of the floodplain, the large number of persons involved, and the unavailability of facilities in neighboring communities to accommodate affected persons, this alternative is not seen as economically or socially acceptable as an effective means of solving flooding problems in the subbasin. However, it is recommended that flood warning and forecasting services be continued in order to alert floodplain residents of impending dangers.

Permanent evacuation of flood prone areas would consist of the acquisition of lands, relocation of improvements, and resettlement of the population, ultimately resulting in the conversion of land use to a state less susceptible to flood damages. Impacts of this alternative would primarily be cultural and economic in nature. Flood proofing would involve structural changes and adjustments to properties in an effort to reduce or eliminate flood damages. This is most effective when applied to new construction, but

can be applied to existing structures in some instances. Permanent evacuation would result in the disruption of long-established social and cultural relationships, but could eliminate flood damages to structural units, providing that floodplain regulations were enforced. Also, the health and safety of floodplain residents would be erhanced and natural habitats would be improved. However, the residual damages to agriculture and the economic, social and cultural impacts of these two measures would more than offset the benefits.

The preceeding discussion summarizes the results of prior Corps of Engineers investigations. In addition to the nonstructural measures mentioned in the Corps reports, there is an opporturnity for the use of land treatment measures throughout the subbasin that would help to contain water on land as well as reduce runoff related erosion damages. Other measures would include, but not be limited to, water retention in existing ditches and preservation of natural retention areas. These would need to be identified and retention capabilities would need to be determined. Wetland restoration could also be considered, where appropriate, for water retention.

IX. ASSESSMENT OF ALTERNATIVES

IX. ASSESSMENT OF ALTERNATIVES

Most of the subbasin is a level featureless lake plain broken only by wave-like swells in the terrain. Recurrent damage to agricultural crops and lands is the major flood problem.

The farmstead levee alternative, which is the only alternative considered in this report, is based on data obtained from studies by the Corps of Engineers. Capital costs are based on October, 1979 level unit construction costs developed in this study and assume that individual owners would construct their own levees. This alternative, which is evaluated in Table 13, consists of the construction of levees around individual farmsteads in the one percent floodplain. These levees would protect individual farmsteads from the one percent frequency flood and could be constructed by private interests. Economic evaluation of this alternative yielded a benefit/cost ratio of 2.10.

Table 13

ECONOMIC EVALUATION OF ALTERNATIVES

Alternative	Acres Protected	Average Annual Acres	Capital Costs	Average Annual Costs	Average Annual Rural Benefits	Average Annual Urban Benefits	Total Average Annual Benefits	B/C Ratio
1. Farmstead Levees (Per Levee)	--	--	$5,600	$400	$840	--	$840	2.10

Source: Gulf South Research Institute.

Impact Assessment

Only one alternative structural measure was recommended for further investigation in this subbasin; the farmstead levees.

Farmstead Levees

Minimally beneficial economic and social effects would result from the protection of several farmsteads in the 100-year floodplain. All other resource elements (biology, water quality, land use, cultural elements and recreation) would not be significantly affected, although consideration must be given to public health and aesthetic factors prior to construction.

X. EVALUATION

X. EVALUATION

Only farmstead levee measures were investigated, and they have benefits that exceed unity. These measures are also the only ones that maximize economic benefits for the subbasin, but they afford only extremely localized protection.

Environmental enhancement would not result from these measures.

National Economic Development (NED) and Environmental Quality (EQ) plans will be tentatively formulated in association with the Red River of the North basin reconnaissance report.

XI. ADDITIONAL STUDY NEEDS

XI. ADDITIONAL STUDY NEEDS

This report was developed almost entirely on the basis of secondary information from readily available planning documents. Data available from state and Federal agencies was not fully canvassed, and only a limited number of calls were made to the area. In particular, state university libraries and department resources could not be fully utilized. Thus, the document aims only at a broad-brush perspective. In order to provide a more detailed and in-depth analysis of subbasin resources, problems, and potential solutions, the following additional study needs would have to be fulfilled:

1. A literature search should be conducted to obtain available biological data for the subbasin. Fieldwork should be planned to fill any data gaps which exist with the end result of obtaining good baseline data for the subbasin. This is particularly necessary in those areas where flood control measures have been proposed.
2. Areas of high environmental quality (e.g., prairie remnants) should be identified and inventoried within the subbasin.
3. Updated knowledge of the location, areal extent, and types of wetlands occurring within the specific subbasin boundaries would be extremely useful in determining whether wetland restoration would assist in alleviating flooding problems, as has been indicated by Cernohous (1979), and would provide a comparison for documenting wetland losses since the 1964 inventory.
4. Primary water and sediment quality data are needed to update baseline conditions in the streams of the subbasin, particularly in those areas where flood control measures have been proposed.
5. Information pertaining to wastewater management needs to be updated.
6. The information obtained in items 1-5 above would provide an important data base upon which an impact evaluation of proposed flood control measures can be performed and would provide information relative to the cumulative effects of flood control projects on environmental resources in the subbasin. These projects include those that are in place or proposed.
7. Nonstructural flood damage reduction measures should be thoroughly explored such as those listed below.

- Establishment of buffer areas and curtailment of inappropriate residential, commercial, and other development in floodplains.
- Maintenance and enhancement of existing riparian vegetation along the Elm River and tributaries to conserve and restore wildlife habitats, help control wind and streambank erosion, retain soil on the land, and reduce the amount of sediment, nutrients, and other pollutants entering waterways.
- Maintenance of grassed waterways to reduce erosion.
- Establishment of vegetation in areas of critical erosion.
- Determination of the feasibility of installing water control structures at existing culverts to retain water in drainage ditches for longer periods of time during critical runoff periods to minimize flooding in downstream areas.
- Determination of the feasibility of utilizing "on-farm storage" to control runoff through such means as natural storage areas and control structures on existing culverts.
- Prevention of overgrazing on grasslands and utilization of sound agricultural land use practices.
- Provision for strict enforcement of floodplain management programs within the subbasin.
- The potentiality for land treatment measures (e.g. erosion control measures such as cover crops, greenbelts, reduction in fall tillage, etc.) needs to be thoroughly investigated.

8. The people of the subbasin need to be included in further water resource planning efforts. A public involvement program would provide more complete information on water resource problems and opportunities than is presently available.
9. More study is needed to determine the precise nature of the water supply problems and potential solutions.
10. Potentialities for floodwater storage in present drainage ditches need to be investigated.
11. The effect of drainage works on flood discharges and stages is unknown at present. It would take additional, more detailed studies to determine the extent and effect of reduced natural storage.
12. Land use within the floodplain needs to be precisely identified.
13. An adequate 100-year floodplain map needs to be developed. Also, the extent of floodplain for smaller frequency storms needs to be delineated.

14. More gauging stations need to be developed to provide hydrologic data for establishing flood frequencies and rating curves.

15. Channel cross-sections of the various streams need to be prepared for flood control planning purposes.

16. Crop distribution in the floodplain needs to be precisely identified through contact with county agents, and average annual rural damages need to be updated.

17. The irrigation potentials of the subbasin soils need to be investigated.

18. A comprehensive and up-dated inventory of recreation sites would be required to accurately identify resources.

19. Studies are needed to determine additional demand for recreational facilities, usage of existing facilities, and potential sites.

20. A regional supply and demand analysis for hunting, fishing, and other water based or related recreational pursuits is needed.

21. Whether forested acreages in the floodplain are increasing or declining needs to be precisely determined.

22. A detailed study of the objectives, goals, and programs of the many institutional entities involved in water resources planning, particularly at the local level, is needed to determine the most efficient institutional approach to the resolution of flood problems.

23. A detailed institutional analysis of the subbasin is needed.

24. A detailed social profile of the subbasin is needed.

25. Urban damages need to be recomputed in a systematic fashion.

26. A review of secondary sources and systematic field reconnaissance is needed to identify archeological and historical sites and to determine their eligibility for the nomination to the National Register of Historic Places.

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Appendix A
FLOODPLAIN DELINEATION

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FLOODPLAIN DELINEATION

Prior to this study, no attempt was made to publish even a generalized delineation of the entire Elm River floodplain. In undertaking this task, the present study utilized all known sources to provide the best available data for generalized delineation of the U.S. portion of the subbasin at a scale of 1:250,000. Principal sources were: USGS Flood Prone Area Maps (scale 1:24,000), Federal Insurance Administration flood maps for available incorporated areas, published secondary sources, U.S. Geological Survey (USGS) 7 1/2 minute Topographic maps, and other sources, including derived data where necessary.

The Flood Prone Area Maps published by the USGS provided detailed and highly accurate information of the area mapped. Six sheets covering the west, north, and eastern periphery of the subbasin provided a framework for the overall floodplain delineation. Two USGS 7 1/2 minute topographic quadrangles provided limited additional support.

Unlike the extensive coverage of the Minnesota side provided by Federal Insurance Administration flood maps, only selected incorporated areas are generally available in North Dakota. Neither Cass, Steele, or Traill are generally available in North Dakota. Neither Cass, Steele, nor Traill counties are listed as members of the flood insurance program. In Cass County, however, the communities of Arthur and Hunter do belong to the program and have flood maps for their incorporated areas. However, both communities were included on available USGS flood prone area maps.

Secondary sources, such as the Souris-Red-Rainy Basins Type II Study were also utilized. Published floodplain descriptions and acreage estimates in the Elm River Watershed Work Plan were also consulted. The latter resulted in an additional cross-hatch pattern in Figure II denoting significant floodplain areas described but not precisely delineated.

Appendix B

INVENTORY OF OUTDOOR RECREATIONAL FACILITIES ELM RIVER SUBBASIN

Appendix B

INVENTORY OF OUTDOOR RECREATIONAL FACILITIES[1]
ELM RIVER SUBBASIN

Number	Name	Administration	Location	Acres	Campgrounds[2]	Playground	Athletic Field[3]	Golf Courses[4]	Boat Ramps	Picnic Tables	Beach	Pool	Trails[5]
1	Augustadt Dam	County	Traill Co. 14453WW11 Galesburg	116.0					1		1		
2	Hunter Park	Municipal	Cass Co. 14352W23 Hunter	18.0	40	2	1			10			

[1]Facilities included are those with 15 or more acres.

[2]Number of campsites.

[3]Number of fields.

[4]Number of holes.

[5]Number of miles.

Source: North Dakota State and Recreation Department, Inventory of North Dakota Outdoor Recreation Facilities, 1979.

Gulf South Research Institute.

Appendix C

COMMENTS

Appendix C

COMMENTS

The purpose of this subbasin report was to provide an overview of the water and related resource problems and needs and to assess potential solutions. Toward this end, draft copies of this report were circulated to Federal, State, and local agencies and comments were sought.

This review resulted in complete and factual documentation. Thus, the study should serve as a building block for the timely completion of future water resource efforts within the subbasin. Further cooperative efforts are, however, needed to evaluate these tentative results and to develop potential solutions.

A distribution list and copies of the comments made with respect to the draft report are included as part of this appendix. Comments that resulted in specific modifications to the draft text are marked by an asterisk.

DEPARTMENT OF THE ARMY
ST PAUL DISTRICT CORPS OF ENGINEERS
1135 U S POST OFFICE & CUSTOM HOUSE
ST PAUL, MINNESOTA 55101

REPLY TO
ATTENTION OF:
NCSED-PB

15 September 1980

Mr. Mike Liffmann
Project Manager
Gulf South Research Institute
8000 GSRI Avenue
Baton Rouge, Louisiana 70808

Dear Mr. Liffmann:

The draft Elm River subbasin report was distributed for review and comment. A few of the reviewers have sent their comments to us.

a. Inclosure 1 includes letters from various Federal and State agencies. Other letters, when received, will be provided under separate cover.

b. Inclosure 2 is the general office comments that need to be considered when preparing the final Elm River subbasin report and the remaining subbasin reports and the overall document.

c. Inclosure 3 identifies specific office concerns that are applicable to the Elm River subbasin report.

If you have any questions on our comments or proposed modifications, please contact us.

Sincerely,

for LOUIS E. KOWALSKI
Chief, Planning Branch
Engineering Division

3 Incl
As stated

UNITED STATES DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
P. O. Box 1458, Bismarck, ND 58502

August 22, 1980

Colonel William W. Badger
District Engineer
St. Paul District, Corps of Engineers
1135 U.S. Post Office & Custom House
St. Paul, Minnesota 55101

Dear Colonel Badger:

Following are our comments concerning the Red River of the North reconnaissance study being conducted for the Turtle, Goose, Elm and Rush subbasins.

Turtle River:

Page 9, Flood Damages - The city of Emerado and the small community of Arvilla, located in the subbasin, are also flood prone.

Page 14, Public Perception of Problems and Solutions, first paragraph - We believe the problems in the subbasin are well known. Many solutions have been suggested by various parties, both public and private. Further, if the statement that problems and solutions are not well defined and this reconnaissance report does not spell them out, Gulf South Research Institute did not complete their research.

Second paragraph - The Upper Turtle River Watershed Work Plan was prepared by the sponsors with assistance by U.S. Department of Agriculture, Soil Conservation Service and Forest Service, not by the Minnesota Soil Conservation Service.

Goose River:

Page 42, Threatened or Endangered Species - We question the inclusion of the black bear if it prefers extensive stands of forests. The Turtle River subbasin has 0.7 percent forest (Pages 24 and 25). How long ago was the bear reported for Traill County?

Elm River:

Page 13, Public Perception of Problems and Solutions, first paragraph - This trite statement appears in several of the subbasin reports. It implies that unless the Corps has conducted public meetings, the public is ignorant. We don't believe this.

* Second paragraph - The Elm River Watershed Work Plan was prepared by the local sponsors with assistance by the U.S. Department of Agriculture, Soil Conservation Service in 1957, not 1972.

* Third paragraph - Local sponsoring agencies have entered into working agreement. The plan has been carried out and the project is completed.

* Page 25, First paragraph - The Elm River is classed as an intermittent stream. We don't believe channelization had anything to do with it. Rainfall, snowmelt runoff, etc., dictate streamflow. Channelization does not influence climate.

* Page 34, Last paragraph - With only 0.1 percent of the area in forest, we expect the absence of habitat is the reason for the decline of the black bear rather than hunting and trapping. When was the black bear last reported in Traill County?

Rush River:

Page 13, Public Perception of Problems and Solutions - Same trite statement; however, the second paragraph almost contradicts it in that the Corps reports on a public hearing.

Sincerely,

Charles E. Mumma
Assistant State Conservationist (WR)

STATES' CURRENT NORMALIZED PRICES FOR PRINCIPAL COMMODITIES: REVISED Aug 1980 ISSUED OCTOBER 1979

State	Wheat all(1)	Rye(1)	Soybeans for beans	Corn for grain(1)	Oats(1)	Barley(1)	Flaxseed	Hay, all baled	Dry beans	Sugar beets(2)	Potatoes
Michigan	2.78	1.83	6.19	2.09	1.27	2.17	-	46.48	15.59	26.17	4.58
Wisconsin	2.62	1.96	6.03	2.13	1.13	1.66	-	43.05	-	-	4.40
Minnesota	2.99	2.13	6.13	2.02	1.12	1.91	5.92	45.14	13.41	22.37	3.09
Iowa	2.56	2.10	6.21	2.08	1.15	-	-	44.92	-	-	3.96
North Dakota	3.14	2.00	5.97	2.05	1.08	1.86	5.94	40.02	14.41	21.64	3.16
South Dakota	2.97	2.01	5.81	1.99	1.11	1.72	5.90	40.37	-	-	2.94

(1) Includes allowances for loans outstanding and purchases by the Government valued at average loan and purchase rate. Does not include price support payments.

(2) Does not include payment under the Sugar Act.

C-5

These have been revised - Please check the prices you need

Encl C

United States Department of the Interior
FISH AND WILDLIFE SERVICE
AREA OFFICE—NORTH DAKOTA
1500 CAPITOL AVENUE
P.O. BOX 1897
BISMARCK, NORTH DAKOTA 58501

SEP 2 3 1980

Colonel William W. Badger, District Engineer
St. Paul District, Corps of Engineers
1135 U.S. Post Office and Custom House
St. Paul, Minnesota 55101

Re: Red River Mainstem (CE)

Dear Colonel Badger:

This letter provides U.S. Fish and Wildlife Service (FWS) comments on the Draft Reconnaissance Report recently compiled by Gulf South Research Institute for the Elm River Subbasin in Cass, Traill and Steele Counties, North Dakota.

As expressed in our comments on previous subbasin reports, our major concerns are associated with the woodland, grassland, wetland, riverine and riparian flood-plain habitats that still remain within this subbasin. Much of the woodland, grassland and wetland habitats in the eastern half of the subbasin has been converted to agricultural uses. We agree with the statements on pages 10, 30 and 31 that these remaining grassland, woodland and wetland habitat types are significant and need to be protected, conserved and enhanced within the subbasin.

The report addressed one structural alternative measure that has been identified to date to meet the study's flood damage reduction objective. Our comments relative to this alternative follow:

Alternative 1 - Farmstead Levees

We do not anticipate any adverse environmental impacts due to this alternative providing the dikes are not constructed through wetland areas and impacts to existing woodland vegetation are avoided to the extent possible.

Generally, we believe the draft report to be well written and it provides a good overview of the water and related land resources, problems and possible solutions to some of these problems within this subbasin of the Red River of the North. We suggest, however, that the following changes be made in the report:

*1. Page 31, first paragraph, under the heading "Waterfowl Production Areas" - We suggest this parpagraph be changed to read as follows:

> Waterfowl Production Areas (WPA's) are wetland areas that the U.S. Fish and Wildlife Service (USFWS) has either acquired through fee title, or obtained an easement interest to preserve valuable breeding, nesting and feeding habitat for migratory

waterfowl. These wetland areas are purchased, or an easement interest obtained, with funds received from the sale of migratory bird hunting and conservation stamps (Duck Stamps). These WPA's are significant because they provide the public with a great variety of wildlife-orientated recreational opportunities, as well as providing valuable habitats for migratory waterfowl and many other forms of wildlife. USFWS is responsible for the compatibility determinations (uses) and the issuance and denial of permits involving these lands. WPA's acquired in fee titled are managed for optimum wildlife production, particularly waterfowl. On easement WPA's, the rights acquired are limited to the burning, draining and filling of wetland basins and the right of access. All other property rights remain with the landowners. The approximate locations of the WPA's acquired in fee within the subbasin are shown in Figure IV. Total acreage of these WPA's, fee and easement, within this subbasin are given in Table 9.

*2. Page 33, Figure IV - Place "fee tracts" in parenthesis after the legend. We belive at least four WPA's should also be identified by a dot in Figure IV. We have attached a copy of Figure IV indicating the approximate locations of these WPA's (Attachment 1).

*3. Page 35, first paragraph, first sentence, under the heading "Rare and Unique Plants" - Remove "(no date)" and insert "(1976)".

4. Page 45, last paragraph, under the heading "Nonstructural Measures" - We suggest the following sentences be added to this paragraph:

Additional study recommendations have been included in Section XI on pages 53-55 of this report. In particular, Recommendation Nos. 7, 10, 12 and 27 should be totally explored to reduce flooding throughout the Goose River Subbasin.

*5. Page 55, Add Recommendation No. 27 - We suggest the following additional study need recommendation be added:

The potentiality for land treatment measures in (e.g., erosion control measures such as cover crops, greenbelts, reduction of fall tillage, etc.) needs to be thoroughly investigated.

*6. Page 56, Bibliography Citation No. 1 should read as follows:

Barker, William T., Gary Larson and Richard Williams. 1976. "Rare and Unique Plants of North Dakota." Department of Biology, Agricultural Experiment Station, North Dakota State University, Fargo, North Dakota.

*7. Page 59, Bibliography Citation No. 10 should read as follows:

_____. 1978. Terrestrial and Aquatic Resources Package for North Dakota Tributaries to the Red River of the North. Area Office, Bismarck, North Dakota.

*3. Page 59, Bibliography Citation No. 11 should read as follows:

_____. 1980. Terrestrial Resources Package for Minnesota Tributaries to the Red River of the North. Ecological Services Office, St. Paul, Minnesota.

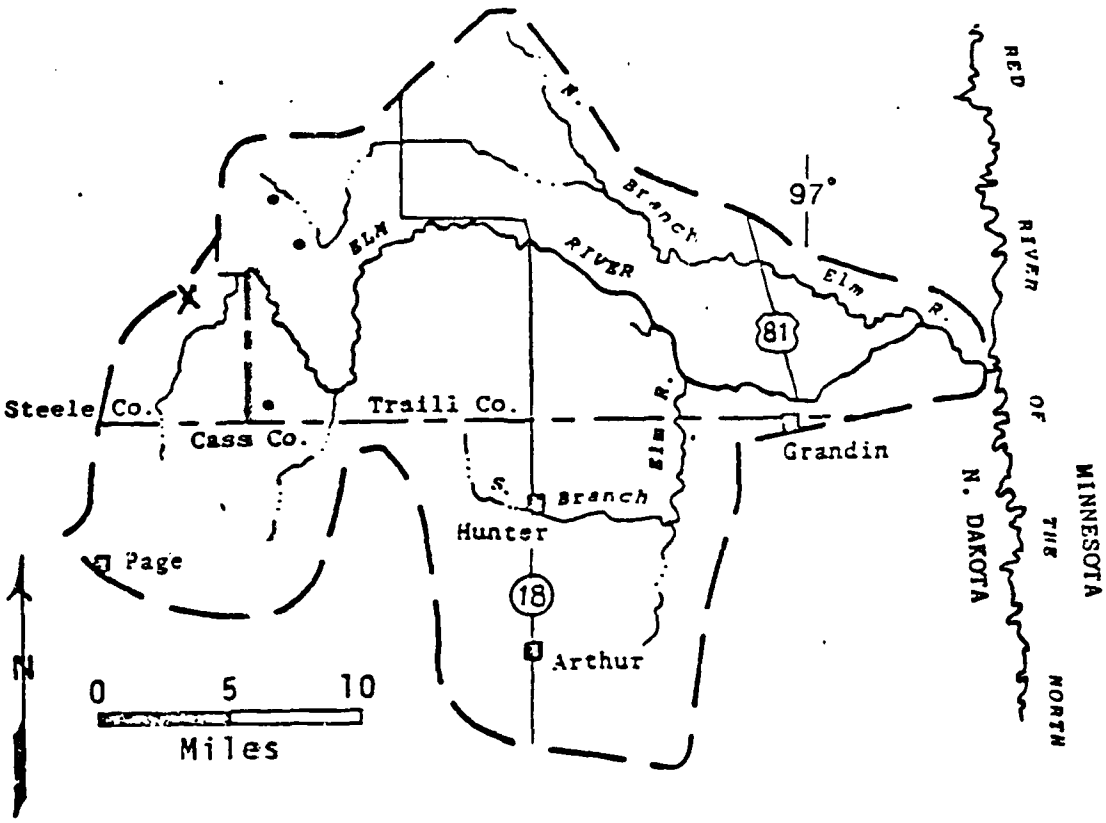
These comments have been prepared under the authority of and in accordance with the provisions of the Fish and Wildlife Coordination Act (48 Stat. 401, as amended; 16 U.S.C. 661 et seq.) and other authorities mandating Department of the Interior concern for environmental values. They are also consistent with the intent of the National Environmental Policy Act of 1969.

The opportunity to review and comment on the Draft Reconnaissance Report of the Elm River Subbasin is appreciated.

Sincerely yours,

Gilbert E. Key
Area Manager

Attachment (1)



• WATERFOWL PRODUCTION AREAS (Fee Tracts)

*Exact locations and numbers of Waterfowl Production Areas are on file at the U.S. Fish and Wildlife Service, Area Office, Bismarck. No copies of these maps have been published or released but can be reviewed at the above office.

Source: State Comprehensive Outdoor Recreation Plan, 1975; USFWS, 1980.

Figure IV. WATERFOWL PRODUCTION AREAS (Fee Tracts)

[redacted]

[redacted]

[redacted]

September 8, 1980

Col. William W. Badger, District Engineer
St. Paul District Corps of Engineers
1135 U.S. Post Office & Customhouse
St. Paul, MN 55101

RE: Red River Mainstem Study - SWC Project #1701

Dear Col. Badger:

This letter is to provide comments on the draft reports for the Goose, Turtle, Park, Elm, Rush, and Forest River Subbasin reports for the Red River of the North Reconnaissance Study. Although, the reports are satisfactory, it is recognized that they are specific to flood control problems. As stated previously, it is hoped that solutions for total water management can be addressed in the final basin report.

In reviewing the Goose River Subbasin Report, mention was found of the water supply problems experienced by the City of Mayville. Since lack of water by the city has been a significant problem for Mayville in recent years, it is believed that more emphasis should be placed on describing this problem. In addition, alternatives should be considered for improving Mayville's water supply. On page 49 of the report, there is discussion of flood control planning for the subbasin. Since the State Water Commission has authority in flood control planning, this agency should be included in the discussion. There appears to be an error on the map on page 51, in that it shows the subbasin to have 10 existing Corps of Engineers reservoirs. On page 52 of the report mention is made of the use of present drainage ditches for flood water storage. It is questioned whether or not this is practical and feasible.

The Turtle River Subbasin Report contains an error on page 14, where it is stated that the Upper Turtle River Watershed Work Plan was published by the Minnesota Soil Conservation Service. As in the Goose River report, mention should be made that the StateWater Commission should also be involved in additional efforts in flood control planning. This is discussed on page 44 of the Turtle River report. In the formulation of alternative measures section, it should be mentioned that for alternatives 1, 2, and 3, that other agencies such as the State Water Commission or water management boards could be the implementing agency.

In the Park River Subbasin Report, the water supply section states that the City of Grafton relies solely on the Park River for its water. This is not true, since the City of Grafton has recently completed a pipeline to the Red River. Again, the State Water Commission should be identified as an agency that has the authority for flood control planning for this river basin. A recent study of the flood problem at Grafton by the State Water Commission revealed that a snagging and clearing project on the Park River downstream from Grafton would reduce the flood damage in Grafton considerably. Consideration should be given to including snagging and clearing of the Park River in this vicinity as another structural alternative.

* The irrigation section of the Elm River Subbasin Report states that very limited amounts of acreage in the basin are being irrigated. The identification of the Page aquifer and increased interest in irrigation has resulted in an increase in irrigation in the basin in recent years. In considering the systems that have been developed and the interest in developing additional systems, it can be stated that substantial amounts of acreage in the subbasin are being irrigated.

The Rush River Subbasin Report states that the subbasin includes portions of three water management districts. Although this may be true since legal descriptions are used to describe the water management districts, for the most part it is commonly accepted that all of the Rush River Subbasin is within the jurisdiction of the Rush River Water Management Board. Again, it must be stated that the State Water Commission has jurisdiction for flood control planning for the subbasin along with the other federal and local entities.

The water supply section of the Forest River Subbasin Report states that water supply in the subbasin is adequate. This is true from a quantity standpoint, although the City of Minto is in serious need of a new water supply dam, since their existing dam is damaged beyond repair. As stated before, mention of State Water Commission authority for flood control planning should be added to the report.

Oftentimes in the reports, GSRI is mentioned as a source for data. If this is updated data from other reports, the method for updating the data should be described. Data from the published county ground water reports could be used for ground water aquifer identification in the subbasin.

Sincerely,

David A. Sprynczynatyk, P.E.
Director of Engineering

DAS:smh

General Comments
Elm River Subbasin Draft Report
(July 1980)

(These comments apply to the entire report and all subsequent subbasin documents)

1. Comments from Federal, State, and local agencies and a letter from the St. Paul District will be included in an appendix in each final subbasin and in the overall report. The format for the appendix will be:

a. Introduction - This section should stress:

(1) The importance of completing the study on time.

(2) That the purpose of the study is to advise other agencies and interests.

(3) The need for a selected review by various interests to provide complete and factual documentation.

(4) The use of the study as a building block for future water resource efforts.

(5) That cooperative efforts to evaluate results and develop solutions to remaining problems will be incorporated.

(6) A complete public involvement program when the study is finished.

b. The distribution list.

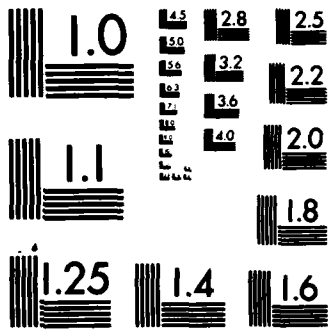
c. Copies of letters of comment.

Only comments that identify significant errors or need specific attention will be addressed in the final subbasin report. However, all comments incorporated should be identified with a marking system. The distribution list for the Elm River Subbasin Report is given below:

Agencies receiving draft report	Date sent	Date comments received
Federal		
Soil Conservation Service	15 Aug 80	25 Aug 80
Fish and Wildlife Service	15 Aug 80	-
Corps of Engineers, North Central Div.	15 Aug 80	-
Corps of Engineers, St. Paul District	15 Aug 80	25 Aug 80
State - North Dakota		
North Dakota Game & Fish	15 Aug 80	-
North Dakota State Planning	15 Aug 80	-

AD-A140 704 RED RIVER OF THE NORTH RECONNAISSANCE REPORT: ELM RIVER SUBBASIN(U) GULF SOUTH RESEARCH INST BATON ROUGE LA DEC 80 DACW37-80-C-0017 2/2

UNCLASSIFIED F/G 8/8 NL



Local

Red River Joint Water Management Board 19 Aug 80

2. Care should be taken to ensure that similar data reported in the various draft reports is uniform and consistent. For example, in the climate sections temperatures are recorded in ranges, means, and averages.

3. The supporting information for alternatives including technical, economic, and environmental backup data should be provided (at least under separate cover).

4. All references by the same author and of the same year should be ranked (i.e., 1979a, 1979b, etc.) so that they can be distinguished.

5. The evaluation section of each report is primarily the recommendations of the document. Generally only the alternatives which have a benefit-cost ratio greater than 1 are presented. Little attention is given to other less economically feasible alternatives that may be important in specific aspects of future flood damage reduction planning for the subbasin as well as the basin as a whole. Some of these alternatives may provide the necessary environmental or social conditions to warrant future attention. Therefore, this section should be expanded to provide the appropriate discussions.

St. Paul District Corps of Engineers
Comments on the
Draft Elm River Subbasin Report
(August 80)

1. Page 2- Expand this section to have the same type of content as other subbasin reports. Include (among other things) other reports and the information that was culled from those reports.

*2. Page 3 - It should be mentioned whether all or parts of the river are intermittent or continuous flows. The north and south branches should be discussed as well as any ditching or channel improvements.

3. Page 5, paragraph 1 - In the second sentence, name the reports being cited.

*4. Page 5, Nature of the Problems, paragraph 2 - It is stated that the floods occur 7 out of every 10 years. A discussion of the data used to identify this statement would be helpful. Also, "separate" is misspelled on the top of page 6.

5. Page 8, Flood Damages, paragraph 1 - Is Hunter, subject to flooding? Our records indicate not. Also correct the map on page 7 to indicate that Grandin and Kelso are in the floodplain.

6. Page 8, Flood Damages - Since there was urban flooding in 1979, there should have been rural damages in 1979. Also, how did the average annual flood damages become so great in light of the limited damages occurring in 1975 and 1979 figures? This entire section needs clarification or modification. In addition subsequent discussions on flood damages should be reevaluated.

7. Page 10, Environmental Concerns, paragraph 1 - Area in wetlands should be stated. Also, the land use figures on page 20 indicate that 0.06 percent of the land area is classified as water. This figure, instead of 1.4 percent, should be used when discussing wetland acreages on page 10. In addition, the discussion on water quality on pages 10 and 11 is inconsistent. This discussion should agree with information presented on pages 25 and 26.

*8. Page 13, Hydropower - The second sentence should be deleted.

*9. Page 13, Public Perceptions of Problems and Solutions - The reason that the public perception of problems and solutions is not adequately defined is not because the Corps has not conducted public meetings in the area. It is doubtful that a few public meetings would have enabled these factors to be adequately defined. The social analysis which would yield this information is identified on page 67 of this report as an area needing further study. This sentence should be rewritten to reflect other limitations besides the lack of public meetings.

*10. Page 15 - Change sentence "... it is evident that residents of the Red River Basin consider flood control..." to read "...it is evident that most residents of the Red River Basin consider flood control...". The original statement implies that this opinion is shared by all the residents of the basin. It is quite probable that some residents may think other water-related problems are more important; e.g., the farmer living in an upland area who has water supply problems.

*11. Page 16, Social Characteristics, paragraph 1 - The second sentence is incorrect as there are portions of three counties in the subbasin.

12. Page 16, Social Characteristics - A more thorough explanation is needed of how the Fargo metropolitan area and Cass County in general affect subbasin population fluctuations. If there is a more direct relationship then this should be explained.

13. Page 16, Social Characteristics, paragraph 1 - It is stated that 33 percent of the population is of Norwegian heritage. Identify the major components of the other 67 percent.

*14. Page 16, Social Characteristics - While length of time living and working in one house, county, etc., may contribute to cohesiveness, it is not a measure of cohesiveness as intimated. A different term or a rewrite of the sentence should be used.

*15. Pages 17 and 19 - What is the correction factor used to convert income figures to 1979 dollars? It would be helpful if it were included. Also, change in line 7 "1960 and 1970" to "1960 and 1970" and in line 9 "farmers to plan" to "farmers to plant."

16. Page 17 - The distribution of income (such as percentage of population below the poverty level, etc.) should be included.

17. Page 18, Agriculture, paragraph 1 - It is stated that the number of farms decreased by more than 8 percent. Total numbers should accompany these percentages.

*18. Page 18, Agriculture, paragraph 2 - In the fifth sentence, it is stated that sunflower increases parallel that of the state. Clarify. If the intent is to say that the area is in line with what is being grown statewide, that is normal, not significant.

19. Page 18 - In addition to the factors noted on yield per acre, harvested acres, and total production for particular crops, it would be helpful if gross income per acre for particular crops were included. This information would give a better understanding of the relative importance of each crop. One other factor that would aid understanding of flooding problems is the differential in susceptibilities of crops to flood damages. Some crops are not as seriously affected by a flood event as others. In addition, the differential in costs per acre to plant particular crops would aid understanding.

20. Page 20, Land Use, paragraph 1 - 94 + 2.8 + 1.7 + .1 + .6 = 99.2 percent. The remaining .8 percent, if it is a wetland area, should be identified.

*21. Page 20, Climate - It is unlikely that this area of North Dakota has ever reached a temperature of 140°F. This should be corrected to 104°F.

*22. Page 21, Biology - It is suggested that the vegetative communities be described in the present tense.

23. Page 23, last paragraph - What is the area drained by the 2 branches? This should be identified.

*24. Page 24, Table 6 - Are the county totals for only that portion of the county which lies in the subbasin or for the county as a whole? This should be clarified.

25. Page 25, Water Supply Section - It is stated that four communities have municipal water supplies, yet only three are identified. The fourth should also be identified.

26. Page 26, Table 6 - Should Grandin be included? What units are to be used with the data? What are minimum or maximum standards for the state?

*27. Page 27 - Eliminate "some" from the following sentence. "It is reasonable to expect that ... will yield some evidence..." Judging from the other subbasins, it is highly probable that sites will exist in this basin as well.

*28. Page 27 - Change the last sentence to read, "There are no sites listed on or eligible for listing on the National Register at this time."

29. Page 28 - In addition to the information presented, a discussion of the social consequences or implications of flood events should be presented, particularly those concerning behavioral damages that may occur.

*30. Page 34, Table 9 - It should be indicated that the column total is also in acres.

*31. Page 34, Threatened and Endangered Species - This section should specify that the black bear and river otter are considered endangered only in North Dakota and are not listed Federally as endangered. The loss of suitable habitat, rather than hunting and trapping, was probably the primary reason for the population decline of these species.

*32. Page 37, top paragraph - It should read, "spin-off effects from the Fargo metropolitan area..."

*33. Page 37, last paragraph - It should be Table 12, not Table 11.

*34. Page 38, Table 12 - The total increase from 1980 to 2030 should be $99,900, not $99,000.

*35. Page 39, paragraph 5 - Table 12 indicates that there are no urban flood damages. How can there be a 1 percent rate when there are no urban damages for the subbasin? Clarify.

36. Page 45, paragraph 1 - The wetland percentages given should be discussed in more meaningful terms to local and state interests. It appears that most of the discussion concentrates on general information that may or may not be meaningful on a local basis.

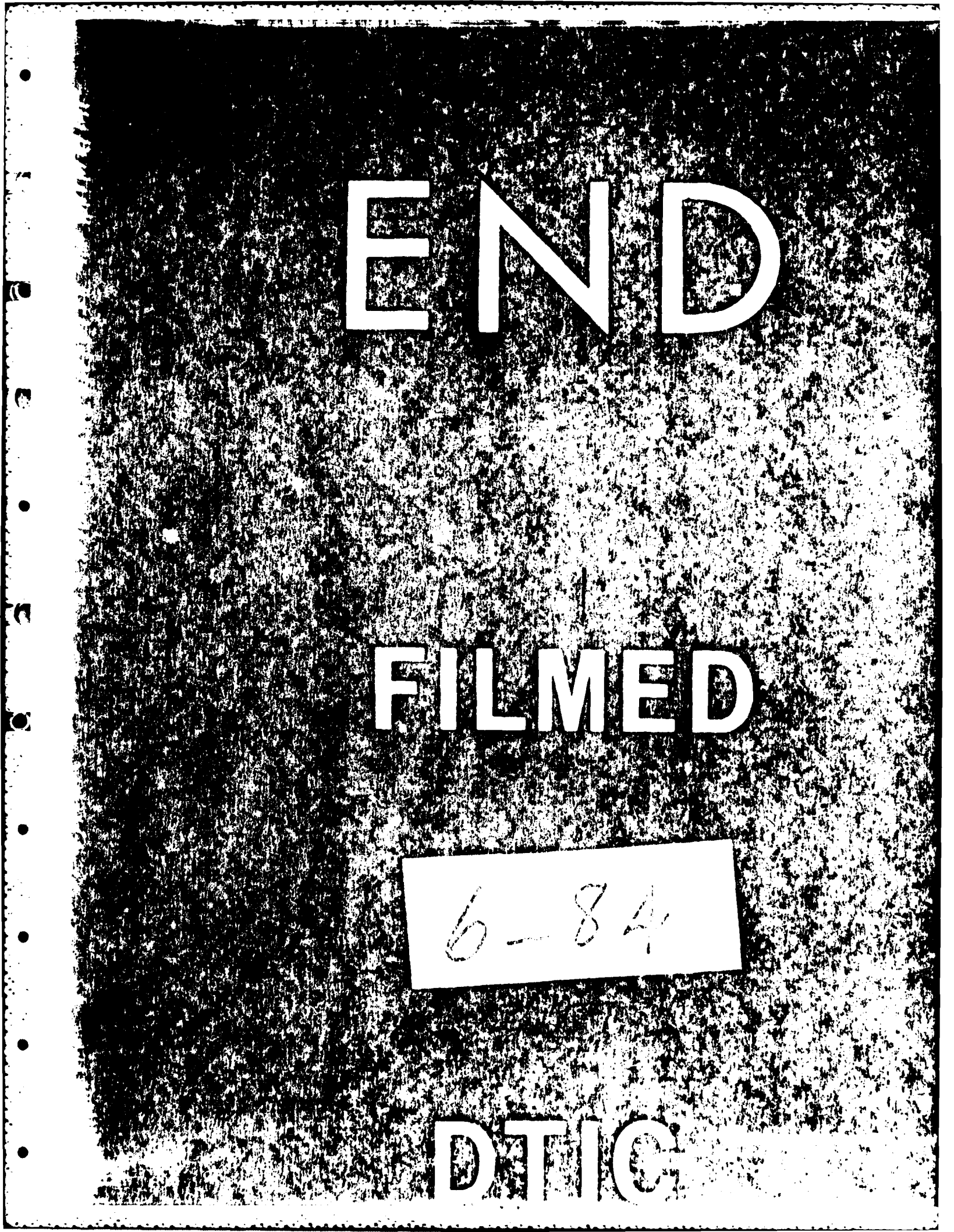
*37. Page 46, PIanning Objectives Section - The second paragraph seems to be too strongly stated. The following rewrite is suggested:

> The development of planning objectives involved a broad-range analysis of the needs, opportunities, concerns, and constraints of the subbasin from the information that was available. On the basis of this analysis of the problems, needs, and desires that could be identified, the following planning objectives were established.

*38. Page 51, Table 13 - The B-C ratio of 2.10 should be listed.

39. Page 55, Additional Study Needs - It should be noted in each subbasin report that the probability of institutional and social boundaries being the same as subbasin boundaries is remote. Since this boundary-overlap exists, integrated basin-wide social and institutional analysis are desirable.

40. Bibliography Section - See general comment No. 4.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6-84
DTIC